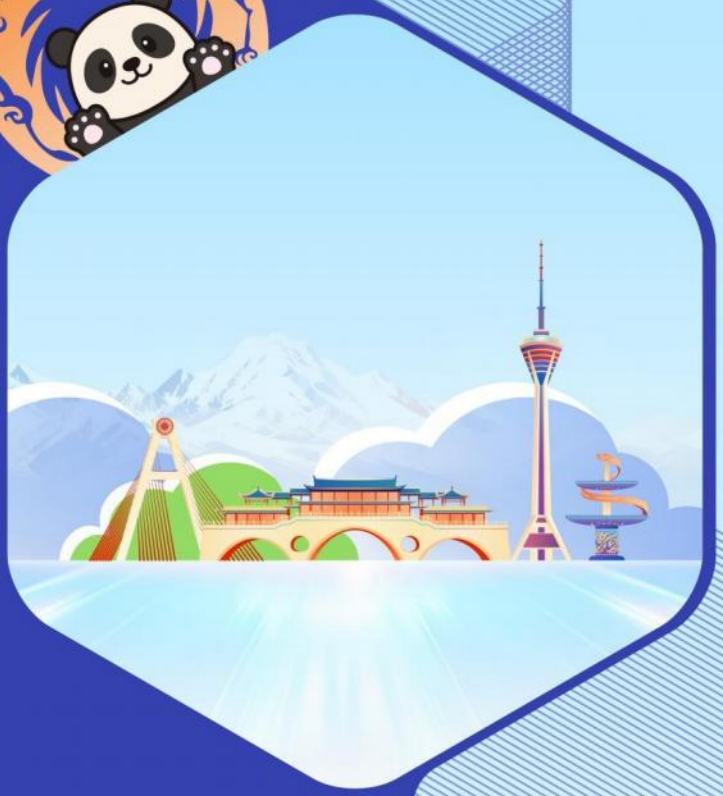
IEEE NEMS 2026



2026 IEEE 21st International Conference on Nano/Micro Engineered and Molecular Systems

CONFERENCE PROGRAM

Chengdu, China April 17-21, 2026

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电子科技大学 — 70周年校庆 — 70th ANNIVERSARY OF UESTC 1956–2026

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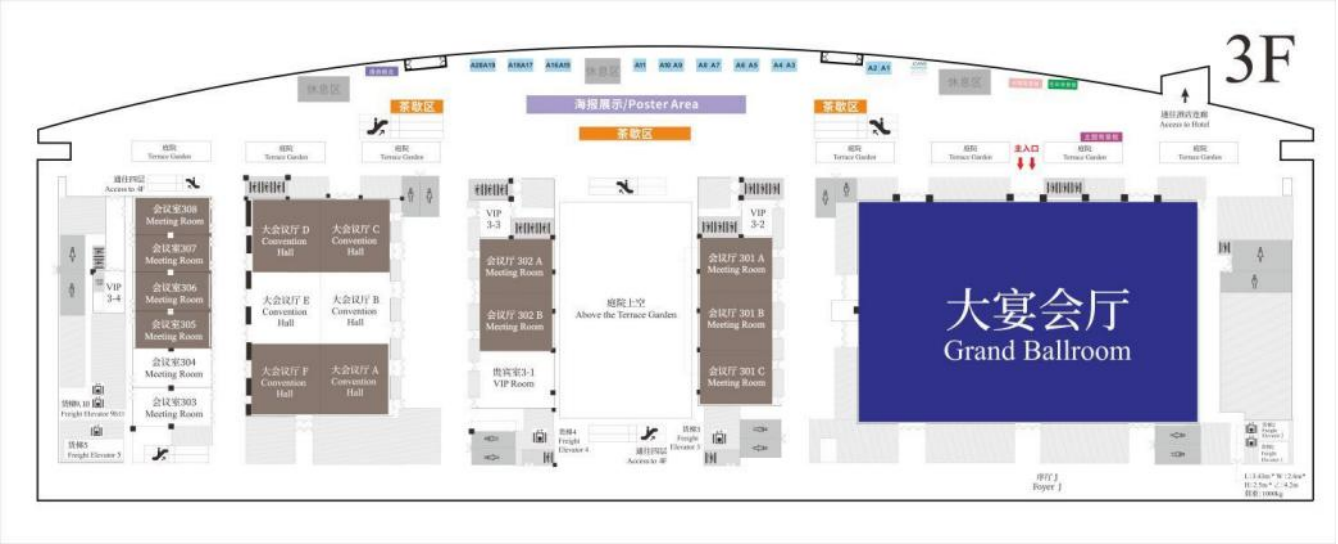
Conference Venue

Chengdu Airport International Conference Center（成都空港国际会议中心）

No. 1555, South Section of Chengshuang Avenue, Shuangliu District, Chengdu, Sichuan, China.
成都市双流区成双大道南段 1555 号



Meeting Rooms	Apr. 18	Apr. 19	Apr. 20	Meeting Rooms	Apr. 18	Apr. 19	Apr. 20
Grand Ballroom	✔	✔	-	Meeting Room 301C	✔	✔	✔
Convention Hall A	✔	✔	✔	Meeting Room 302A	✔	✔	✔
Convention Hall C	✔	✔	✔	Meeting Room 302B	✔	✔	✔
Convention Hall D	✔	✔	-	Meeting Room 305	✔	✔	✔
Convention Hall F	✔	✔	✔	Meeting Room 306	✔	✔	✔
Meeting Room 301A	✔	✔	✔	Meeting Room 307	✔	✔	✔
Meeting Room 301B	✔	✔	✔	Meeting Room 308	✔	✔	✔

Agenda Overview

April 17, 2026

On-Site Registration & Materials Collection

10:00-20:00

Site 1: Lobby @ Chengdu Aerotropolis International Convention Center Hotel
Site 2: Foyer @ Grand Ballroom/3F, Convention Center

Welcome Reception

18:30-20:00

Convention Hall (3F)

iCANX Chengdu Summit & 6th Years Anniversary

20:00-21:30

Convention Hall (3F)

Speaker **Sheng Xu**
Stanford University

Moderator **Alice Zhang**
Peking University

Panelist **Paul S. Weiss**
University of California, Los Angeles

Panelist **Lan Fu**
The Australian National University

Panelist **Martin Thuo**
North Carolina State University

Panelist **Miso Kim**
Korea Advanced Institute of Science and Technology

Panelist **Rong Chen**
Huazhong University of Science and Technology

Panelist **Xiaosheng Zhang**
University of Electronic Science and Technology of China

Agenda Overview

April 18, 2026 | Morning

09:00-12:00, April 18, 2026 — Grand Ballroom

Opening Ceremony

09:00-09:15 Opening Remarks & Welcome Address

Plenary Speaker(s)

09:15-10:00 Plenary Talk

Zhonglin Wang

Beijing Institute of Nanoenergy and Nanosystems, CAS, China

Speech Title: Triboelectric Nanogenerators (TENG) for Sustainable Energy and Sensing

10:00-10:45 Plenary Talk

Seeram Ramakrishna

Tsinghua University, China

Speech Title: Towards Intelligent Wearables

10:45-11:15 Coffee Break

11:15-12:00 Plenary Talk

Yi Shi

Nanjing University, China

Speech Title: Tactile Sensor Technologies for Embodied Intelligence

Agenda Overview

April 19, 2026 | Morning

09:00-12:00, April 19, 2026 | **Grand Ballroom**

Plenary & Keynote Speaker(s)

09:00-09:45 **Plenary Talk**

Paul S. Weiss

University of California, Los Angeles, USA

Speech Title: Mimicking Nature: Controlling Charge, Heat, and Spin at Interfaces

09:45-10:15 **Keynote Talk**

Andrey L. Rogach

City University of Hong Kong, China

Speech Title: Perovskite Light-Emitting Devices

10:15-10:45 **Panel Discussion & Coffee Break**

10:45-11:30 **Plenary Talk**

Jürgen Brugger

Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

Speech Title: Beyond the Mask: Direct-Write Nanofabrication and Immersive Learning for Next-Generation Microsystems

11:30-12:00 **Keynote Talk**

Alice Zhang

Peking University, China

Speech Title: iCANX Connect the World, Drive the Future

April 18, 2026

Afternoon

Time	Activities	Venue
15:00-17:00	Poster Award Session & Poster Session 01	Foyer
13:30-15:30	Micro/Nano Energy Devices and Self-Powered Systems	Meeting Room 301A
13:30-15:40	Flexible Functional Materials and Devices	Meeting Room 301B
13:30-15:30	Micro/Nano Sensing-Memory-Computing Devices	Meeting Room 301C
13:30-15:20	Micro/Nano Integrated Devices and Circuit Design	Meeting Room 302A
13:30-15:30	M/NEMS Resonators	Meeting Room 302B
13:30-15:30	Micro-Nano Chemical Sensor	Meeting Room 305
13:30-15:25	Piezoelectric and Acoustic MEMS	Meeting Room 306
13:30-15:30	Micro/Nanomechanical Inertial Sensors	Meeting Room 307
13:30-15:30	Nanodevice Physics	Meeting Room 308
13:30-15:30	Micro/Nanoelectronic Materials and Devices	Convention Hall A
13:30-15:20	Emerging Micro/Nano Technologies	Convention Hall F
13:30-15:00	Advanced Optical Nanometrology and Nanoscopy	Convention Hall C
13:30-15:45	Award Finalist Session: Best Student Paper	Convention Hall D
15:30-16:00 | Coffee Break		
16:00-18:00	Micro/Nano Energy Devices and Self-Powered Systems	Meeting Room 301A
16:00-18:00	Emerging Electromechanical Transduction and Multimode Sensing	Meeting Room 301B
16:00-18:10	Micro/Nano Sensing-Memory-Computing Devices	Meeting Room 301C
16:00-18:10	Micro/Nano Integrated Devices and Circuit Design	Meeting Room 302A
16:00-17:50	M/NEMS Resonators	Meeting Room 302B
16:00-17:50	Micro-Nano Chemical Sensor	Meeting Room 305
16:00-17:20	Piezoelectric and Acoustic MEMS	Meeting Room 306
16:00-17:50	Micro/Nanomechanical Inertial Sensors	Meeting Room 307
16:00-17:50	Nanodevice Physics	Meeting Room 308
16:00-18:20	Micro/Nanoelectronic Materials and Devices	Convention Hall A

16:00-18:00	Award Finalist Session: Best Conference Paper	Convention Hall F
16:00-17:40	Advanced Optical Nanometrology and Nanoscopy	Convention Hall C
16:00-18:00	Award Finalist Session: Best Student Paper	Convention Hall D

April 19, 2026

Afternoon

Time	Activities	Venue
15:00-17:00	Poster Session 02	Foyer
13:30-15:00	Emerging Electromechanical Transduction and Multimode Sensing	Meeting Room 301A
13:30-15:30	Flexible Functional Materials and Devices	Meeting Room 301B
13:30-15:40	Flexible Biosensors	Meeting Room 301C
13:30-15:00	Micro/Nano Integrated Devices and Circuit Design	Meeting Room 302A
13:30-15:30	AI for Micro/Nano Electro-Mechanical Systems	Meeting Room 302B
13:30-15:10	Micro-Nano Chemical Sensor	Meeting Room 305
13:30-15:30	Micro Biosensing and Micro Manipulation & Milli Micro and Nano Robotics	Meeting Room 306
13:30-15:00	Micro/Nano Energy Devices and Self-Powered Systems	Meeting Room 307
13:30-15:10	Nanodevice Physics	Meeting Room 308
13:30-15:30	Micro/Nanoelectronic Materials and Devices	Convention Hall A
13:30-15:30	Award Finalist Session: Best Student Paper	Convention Hall F
13:30-15:00	Advanced Optical Nanometrology and Nanoscopy	Convention Hall C
13:30-15:30	Award Finalist Session: Best Student Paper	Convention Hall D
15:30-16:00 | Coffee Break		
16:00-17:20	Emerging Electromechanical Transduction and Multimode Sensing	Meeting Room 301A
16:00-18:00	Flexible Functional Materials and Devices	Meeting Room 301B
16:00-17:50	Flexible Biosensors	Meeting Room 301C
16:00-18:00	M/NEMS Resonators	Meeting Room 302A
16:00-17:40	AI for Micro/Nano Electro-Mechanical Systems	Meeting Room 302B
16:00-17:35	Micro-Nano Chemical Sensor	Meeting Room 305
16:00-18:05	Piezoelectric and Acoustic MEMS	Meeting Room 306
16:00-17:20	Micro/Nano Energy Devices and Self-Powered Systems	Meeting Room 307
16:00-17:20	Nanodevice Physics	Meeting Room 308
16:00-18:20	3D Printing and Bioprinting	Convention Hall A

16:00-18:00	Award Finalist Session: Best Student Paper	Convention Hall F
16:00-17:30	Micro/Nanomechanical Inertial Sensors	Convention Hall C
16:00-17:15	Award Finalist Session: CM Ho Best Paper Award in Micro/Nanofluidics	Convention Hall D
✨***18:30-20:00 | Banquet @ Grand Ballroom***		

April 20, 2026

Morning

Time	Activities	Venue
15:00-17:00	Poster Session 03	Foyer
09:00-10:10	Micro Biosensing and Micro Manipulation	Meeting Room 301A
09:00-10:00	Flexible Functional Materials and Devices	Meeting Room 301B
09:00-10:30	Micro Biosensing and Micro Manipulation	Meeting Room 301C
09:00-10:10	Micro/Nanofabrication and Sensor	Meeting Room 302A
09:00-10:00	AI for Micro/Nano Electro-Mechanical Systems	Meeting Room 302B
09:00-10:10	Non-linear Mechanisms Enabled M/NEMS	Meeting Room 305
09:00-10:40	Flexible Biosensors	Meeting Room 306
09:00-10:10	Biomimetic Microelectromechanical Systems (MEMS) Technology	Meeting Room 307
09:00-10:10	Surface/Interface Functional Electronics	Meeting Room 308
09:00-10:20	3D Printing and Bioprinting	Convention Hall A
09:00-10:00	Micro/Nanofabrication and Sensor	Convention Hall F
09:00-10:10	Micro/Nanofabrication Techniques and Devices	Convention Hall C
10:00-10:30 | Coffee Break		
10:30-11:40	Micro Biosensing and Micro Manipulation	Meeting Room 301A
10:30-11:30	Micro/Nano Electro-Mechanical Systems (M/NEMS)	Meeting Room 301B
10:30-11:30	Micro Biosensing and Micro Manipulation	Meeting Room 301C
10:30-12:20	Micro/Nanofabrication and Sensor	Meeting Room 302A
10:30-12:00	Micro/Nano/Molecular Physical/Chemical Sensors/Actuators	Meeting Room 302B
10:30-12:00	Non-linear Mechanisms Enabled M/NEMS	Meeting Room 305
11:00-11:30	Piezoelectric and Acoustic MEMS	Meeting Room 306
10:30-12:00	Biomimetic Microelectromechanical Systems (MEMS) Technology	Meeting Room 307
10:30-11:50	Surface/Interface Functional Electronics	Meeting Room 308
10:30-12:10	3D Printing and Bioprinting	Convention Hall A
10:30-11:30	Functional Nanomaterials and Synthesis & Micro/Nano/Molecular Fabrication	Convention Hall F

10:30-11:30	Micro/Nanofabrication Techniques and Devices	Convention Hall C
12:00-13:30 | Lunch		

Afternoon

Time	Activities	Venue
13:30-15:20	Micro Biosensing and Micro Manipulation	Meeting Room 301A
13:30-15:30	Micro/Nano Electro-Mechanical Systems (M/NEMS)	Meeting Room 301B
13:30-14:50	Micro Biosensing and Micro Manipulation & Milli Micro and Nano Robotics	Meeting Room 301C
13:30-15:30	Micro/Nanofabrication and Sensor	Meeting Room 302A
13:30-15:30	Micro/Nano/Molecular Physical/Chemical Sensors/Actuators	Meeting Room 302B
13:30-15:05	Non-linear Mechanisms Enabled M/NEMS	Meeting Room 305
13:30-15:30	Micro/Nano Integrated Devices/Circuits/Systems	Meeting Room 306
13:30-15:10	Biomimetic Microelectromechanical Systems (MEMS) Technology	Meeting Room 307
13:30-15:00	Surface/Interface Functional Electronics & Micro/Nano Integrated Devices/Circuits/Systems	Meeting Room 308
13:30-15:00	Micro Biosensing and Micro Manipulation & Micro/Nano – Bio-/Medical Devices and Systems	Convention Hall A
13:30-15:20	Radio Frequency Micro/Nanodevices	Convention Hall F
13:30-15:10	Micro/Nanofabrication Techniques and Devices	Convention Hall C
15:30-16:00 | Coffee Break		
16:00-18:00	Micro Biosensing and Micro Manipulation	Meeting Room 301A
16:00-18:15	Micro/Nano Electro-Mechanical Systems (M/NEMS)	Meeting Room 301B
16:00-17:20	Micro Biosensing and Micro Manipulation & Milli Micro and Nano Robotics	Meeting Room 301C
16:00-17:45	Nano Photonics and Micro/Molecular Optical Devices	Meeting Room 302A
16:00-17:30	Micro/Nano/Molecular Physical/Chemical Sensors/Actuators	Meeting Room 302B
16:00-17:30	Micro/Nano Energy Devices and Self-Powered Systems	Meeting Room 305
16:00-17:30	Micro/Nano – Composite Materials and Structures	Meeting Room 306
16:00-18:15	Biomimetic Microelectromechanical Systems (MEMS) Technology & 3D Printing and Bioprinting	Meeting Room 307
16:00-17:45	Micro/Nano – Bio-/Medical Devices and Systems	Meeting Room 308
16:00-17:15	Micro/Nanofabrication and Sensor	Convention Hall A

16:00-18:00	Radio Frequency Micro/Nanodevices & M/NEMS Resonators	Convention Hall F
16:00-17:40	Micro/Nanofabrication Techniques and Devices	Convention Hall C
17:30-19:30 | Dinner		

Plenary Speech

09:15-10:00, April 18, 2026 Grand Ballroom

Zhonglin Wang

Beijing Institute of Nanoenergy and Nanosystems, CAS, China

Biography

Dr. Zhong Lin Wang is a preeminent physicist and materials scientist whose groundbreaking work has revolutionized the fields of nanotechnology, energy harvesting, and self-powered systems. He currently serves as the Director of the Beijing Institute of Nanoenergy and Nanosystems and holds the distinguished titles of Regents' Professor and Hightower Chair (Emeritus) at the Georgia Institute of Technology. Dr. Wang is widely recognized as the pioneer of the nanogenerators field, which has enabled advancements in distributed energy, self-powered sensors, and large-scale blue energy. Additionally, he coined and developed the fields of piezotronics and piezo-phototronics, which have significant implications for third-generation semiconductors.

Dr. Wang's scientific impact is unparalleled. Among 230,000 scientists across all fields worldwide （Top 2%）as ranked by Elsevier and Stanford, he is ranked **#1** simultaneously for career-long scientific impact and single-year scientific impact consecutively from 2019-2024. He is also ranked **#1** respectively in Materials Science and nanotechnology. His research has garnered over 530,000 citations on Google Scholar, with an extraordinary h-index of 347, underscoring his immense influence and contributions to science.

Throughout his illustrious career, Dr. Wang has received numerous prestigious awards, including the Global Energy Prize (2023), Celsius-Linnaeus Lecture Laureate (2020), the Albert Einstein World Award of Science (2019), the ENI Award in Energy Frontiers (2018), the James C. McGroddy Prize in New Materials from the American Physical Society (2014), and the MRS Medal from the Materials Research Society (2011). His groundbreaking work has earned him memberships and fellowships in some of the world's most esteemed scientific academies, including the UK Royal Academy of Engineering, the Chinese Academy of Sciences, US National Academy of Inventors, the European Academy of Sciences, the

European Academy of Engineering, the Korea Academy of Science and Technology (as a foreign member), the Academia Sinica, and the Canadian Academy of Engineering (as an International Fellow).

Wang's pioneering contributions to nanogenerators, piezotronics, and self-powered systems have not only advanced fundamental science but also paved the way for transformative technologies in energy harvesting, sensing, and semiconductor development. His exceptional scientific impact, numerous accolades, and leadership in the global scientific community underscore his status as one of the most influential materials scientists of our time.

Personal website: www.wanggenerator.com

Plenary Speech

"Triboelectric Nanogenerators (TENG) for Sustainable Energy and Sensing"

Abstract: Triboelectric nanogenerator (TENG) was invented by Wang's group in 2012, which is based on the coupling of triboelectrification and electrostatic induction effects for converting mechanical energy into electric power. TENG is playing a vitally important role in the distributed energy and self-powered systems, with applications in internet of things, AL, environmental/infrastructural monitoring, medical science, environmental science, and security. TENG is most effective for utilization of high-entropy energy, which is the random, low-density, low-grade mechanical energy widely-distributed in our living environment and in nature. There are now over 22,000 authors distributed in 100 countries and regions around the globe who have published papers on TENG, and more than 14,000 papers have been published in the field. This presentation will first focus on the advances in fundamental science made due to the discovery of TENG. Then we will focus on the potential industrial impacts that have been made by TENG. We will show how this new field will benefit to the sustainable development of humankinds.

10:00-10:45, April 18, 2026 Grand Ballroom

Seeram Ramakrishna

Tsinghua University, China

Biography

Academician Seeram Ramakrishna is Tsinghua Chair Professor, and Director of iWearables Center, Tsinghua University. He is a cross-fields pioneer advancing nanofibers for diverse applications. He is ranked 11 globally in the field of Nanoscience and Nanotechnology (Elsevier | Stanford list). He is named among the World's Most Influential Minds (Thomson Reuters) and a Highly Ranked Scholar (Scholar GPS) with more than 500 Q1 journal papers, 225 H-Index, and 237,163 citations. His contributions also appeared in Nature, Nature Reviews Methods, Nature Communications, Matter, and so on journals. Highest professional distinctions include Fellow | Academician of Chinese Academy of Engineering; UK Royal Academy of Engineering (FREng); Singapore Academy of Engineering; Indian National Academy of Engineering; ASEAN Academy of Engineering & Technology; International Academy of Engineering and Technology; International Academy of Bionic Science; and World Academy for Artificial Consciousness (WACA). He is also an elected Fellow of AAAS, ASM International, ASME, AIMBE, USA; IMechE and IoM3, UK; ISTE, India; IUBSE (FBSE), and ISBE. He received a PhD from the University of Cambridge, UK, and TGMP from Harvard University, USA. He accumulated advanced research experiences from MIT and Johns Hopkins University, USA; KIT, Japan; and the National University of Singapore.

Plenary Speech

"Towards Intelligent Wearables"

Abstract: The wearables R&D worldwide is progressing towards collecting myriad information of human body and brain. Wearables made of fibrous materials are desired over the thin-film devices owing to their pliability, permeability, and touch comfort compatible to the human body. However, further progress is needed in terms of manufacturability, scalability, performance, sensitivity, intelligence, self-power, information storage, processing & communication, durability, systems integration, and cost. Advances in nanotechnology, meta-materials, quantum materials, intelligent materials, biomimetic sensors, AI, wireless communications, and fiber energy systems to be harnessed to realise future wearables. It is necessary to integrate cross-fields technologies such as nanofibers, smart materials, living materials, sensors, actuators, miniature energy systems, and artificial intelligence | consciousness | mind towards designing and developing intelligent wearables.

11:15-12:00, April 18, 2026 **Grand Ballroom**

Yi Shi

Nanjing University, China

Biography

Yi SHI currently serves as the Dean of the School of Microelectronics at Nanjing University. He received the B.S. degree in Physics from National University of Defense Technology, China, in 1983, and the Ph.D. degree in Physics from Nanjing University, China, in 1989. He joined Nanjing University in 1989, and was promoted to Professor in 1996. In 2002, he was honored with the National Science Foundation of China's Outstanding Young Scientist Award. Since 2006, he has held the distinguished position of Changjiang Professor. In 2025, he was elected as an academician of the Chinese Academy of Sciences in 2025. He is mainly engaged in research on nanostructured materials and the applications in microelectronic and optoelectronic devices.

Plenary Speech

"Tactile Sensor Technologies for Embodied Intelligence"

Abstract: Tactile sensors serve as the core hardware for embodied intelligence to achieve safe, precise, and autonomous interaction in the physical world. In response to the applications of embodied intelligence, the technical routes of tactile sensors are developing in a diversified manner. Various principles have their characteristics in terms of sensitivity, resolution, dynamic response, environmental adaptability, and cost, forming a complementary technological ecosystem. This report reviews and discusses the performance characteristics, integration paradigms, and engineering bottlenecks of current mainstream tactile sensors, and the expectation for the development of the next-generation tactile perception systems for embodied intelligence. Moreover, it presents the related research work of our research group in this field.

09:00-09:45, April 19, 2026 Grand Ballroom

Paul S. Weiss

University of California, Los Angeles, USA

Biography

Paul S. Weiss holds a UC Presidential Chair and is a distinguished professor of chemistry & biochemistry, bioengineering, and materials science & engineering at UCLA. He received his S.B. and S.M. degrees in chemistry from MIT in 1980 and his Ph.D. in chemistry from the University of California at Berkeley in 1986. He was a postdoctoral member of technical staff at Bell Laboratories from 1986-88 and a visiting scientist at IBM Almaden Research Center from 1988-89. He served as the director of the California NanoSystems Institute and held the Fred Kavli Chair in NanoSystems Sciences at UCLA from 2009-14. Before coming to UCLA, he was a distinguished professor of chemistry and physics at the Pennsylvania State University, where he began his academic career in 1989. He has authored over 500 publications, holds over 40 patents, and has given over 1000 invited, plenary, keynote, and named lectures. He is involved in startups from his and other labs in biotechnology, food security, energy, entertainment, and healthcare. Weiss was a member of the U.S. National Committee to the International Union of Pure and Applied Chemistry (2000-05). He has been the technical co-chair of the Foundations of Nanoscience Meetings and thematic chair of the Spring 2009 and Fall 2018 ACS National Meetings. He was the senior editor of IEEE Electron Device Letters for molecular and organic electronics (2005-07), and was the founding editor-in-chief of ACS Nano (2007-2021). At ACS Nano, he won the Association of American Publishers, Professional Scholarly Publishing PROSE Award for 2008, Best New Journal in Science, Technology, and Medicine, and ISI’s Rising Star Award a record ten times.

Plenary Speech

”Mimicking Nature: Controlling Charge, Heat, and Spin at Interfaces”

Abstract: Many interactions and processes in nature operate at low energy and with critical energy balance, enabling repeated cycling and highly efficient transport. Inspired by these processes, we try to understand them, and to replicate them in synthetic systems. The energies involved are well below those

of visible photon energies; thus, we predominantly use tunneling spectroscopies and imaging to probe them. If we could replicate such systems in our devices, we could save most of the energy required to run them. If we could mimic biochemical cycling, we could develop efficient recycling at large scales rather than the extremely labor- and energy-intensive processes of today. We look for underlying principles and what we are currently missing in our understanding. Two of the areas we are exploring are spin conservation in chiral molecules and the roles of polarizability in biological, and now synthetic, systems. Taking this perspective has already led to novel discoveries and inventions, including thermal control with orders of magnitude improvements, in scale, speed, and effect.

10:45-11:30, April 19, 2026 Grand Ballroom

Jürgen Brugger

Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

Biography

Jürgen Brugger is Professor of Microengineering at EPFL, co-affiliated with Materials Science. He leads the Microsystems Laboratory (LMIS1), where his research advances the science of micro- and nanomanufacturing with applications in MEMS, wearable systems, and biomedical devices. His work has been recognized with distinctions such as IEEE Fellow (2016), an ERC Advanced Grant (2017), MNE Fellow (2022), and election to the Swiss Academy of Engineering Sciences (SATW) in 2024. In my lab, I work closely with students and colleagues to develop new approaches in micro/nanofabrication and additive micromanufacturing. Mentoring and teaching are central to my work: I have supervised over 25 PhD students, many of whom have gone on to pursue successful academic and entrepreneurial careers. Seeing their progress and creativity is among the most rewarding aspects of my role. I am particularly interested about translating fundamental research into practice, whether through collaborations or start-ups emerging from the lab. For me, advancing manufacturing science goes together with training the next generation of engineers and scientists.

Plenary Speech

"Beyond the Mask: Direct-Write Nanofabrication and Immersive Learning for Next-Generation Microsystems"

Abstract: Some micro- and nanofabrication is moving beyond conventional mask-based processes toward direct-write and hybrid approaches that enable new materials, structures, and device concepts. This talk highlights recent work from our laboratory on maskless fabrication methods including inkjet printing, nanostencil lithography, and thermal scanning probe lithography. In parallel, we explore how immersive digital tools such as mixed-reality environments can transform cleanroom education and help students grasp the physics behind fabrication processes. Together, these advances illustrate how innovation in both tools and training will shape the future of microsystems engineering.

Keynote Speech

09:45-10:15, April 19, 2026 Grand Ballroom

Andrey ROGACH

City University of Hong Kong, China

Biography

Andrey L. Rogach is a Yeung Kin Man Chair Professor in Photonics Materials at the Department of Materials Science and Engineering, and the Founding Director of the Centre for Functional Photonics (CFP) at City University of Hong Kong. He received his Diploma in Chemistry (1991, with honors) and Ph.D. in Physical Chemistry (1995) from the Belarusian State University in Minsk, and worked as a postdoc and then as a staff scientist at the Institute of Physical Chemistry of the University of Hamburg, Germany from 1995 to 2002. From 2002 – 2009 he held a tenured position of a lead staff scientist at the Department of Physics of the University of Munich, Germany. He joined City University of Hong Kong as a Full Professor in 2009 and has been advanced to Chair Professor in 2012. His research focuses on synthesis, assembly and optical spectroscopy of colloidal semiconductor and metal nanocrystals and their hybrid structures, and their use for energy-related and optoelectronic applications. He authored over 600 scientific publications with an h-index of 154 {Google Scholar} in these fields that have been extensively (over 85,000) cited, which ranked him as Highly Cited Researcher (Clarivate Analytics) in Cross-Field or Materials Science every year since 2018. Andrey Rogach is a Foreign Member of the Academia Europaea, and a Fellow of the Electromagnetic Academy, USA. He served as an Associate Editor of ACS Nano in 2011-2023.

Plenary Speech

"Perovskite Light-Emitting Devices"

Abstract: Chemically synthesized metal halide perovskite thin films and nanocrystals have emerged as a new class of efficient light emitting materials which are particularly interesting for development of light-emitting diodes (LEDs). Stability of perovskite-based LEDs is still an issue, which can be mitigated by choosing proper light-emitting layer, electron transport layer (ETL), and the interface design [1], as we demonstrated recently for FAPbBr3 perovskite films with ultralow trap density in combination with ZnO ETL [2]. This design led to green perovskite light-emitting diodes with a brightness of ~312,000 cd m−2, a half-lifetime of 350 h at 1,000 cd m−2, and a power conversion efficiency of 15.6% at a current density of

300 mA cm−2. As for many other nanocrystals, proper surface passivation is a key to ensure high colloidal stability and processability of perovskites, which can be achieved by choosing bidentate Lewis base ligands [3]. To avoid the use of toxic lead, CsSnI3 perovskites can be implemented for efficient and rather stable near-infrared LEDs. The use of multifunctional hesperetin additive alongside the perovskite precursors allowed us to modulate the crystallization kinetics and inhibit the oxidation process of tin-based perovskite films [4]. We demonstrated near-infrared CsSnI3 perovskite LEDs with a peak at 948 nm, an external quantum efficiency of 4.7%, and a half-time of operation of over 11 h. We have also used pre-synthesized CsPbCl3 perovskite nanocrystals as a chlorine source to enable formation of thickness-controlled, vertically oriented quasi-2D perovskite films for efficient blue LEDs with an external quantum efficiency of over 26% [5].

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2. D. Chen, A. A. Sergeev, N. Zhang, L. Ke, Y. Wu, B. Tang, C. K. Tao, H. Liu, G. Zou, Z. Zhu, Y. An, Y. Li, A. Portniagin, K. A. Sergeeva, K. S. Wong, H.-L. Yip, A. L. Rogach. Ultralow Trap Density FAPbBr3 Perovskite Films for Efficient Light-Emitting Diodes and Amplified Spontaneous Emission. Nature Comm. 2025, 16, 2367.

3. Md. S. Hassan, P. Basera, B. Khan, A. S. Portniagin, K. Vighnesh, Y. Wu, D. A. Rusanov, M. Babak, J.-H. He, M. Bajdich, A. L. Rogach. Bidentate Lewis Base Ligand-Mediated Surface Stabilization and Modulation of Electronic Structure of CsPbBr3 Perovskite Nanocrystals. JACS 2025, 147, 862-873.

4. Z. Liu, G. Wang, L. Kong, J. Wang, Y. Wang, P. Du, L. Wang, S. Wang, A. L. Rogach, X. Yang. Simultaneous Regulation of Crystallization and Suppression of Oxidization in CsSnI3 Perovskite Enables Efficient and Stable Near-Infrared Light-Emitting Diodes. NanoLett. 2025, 25, 7061-7068.

5. Y. Zhou, Y. Hua, S. Li, J. Zhang, H. Wang, W. Yin, X. Zhang, W. Zheng, A. L. Rogach. Use of CsPbCl3 Quantum Dots as a Chlorine Source Enables Formation of Thick Quasi-2D Perovskite Films for High-Performance Blue Light Emitting Diodes. Adv. Mater. 2025, 37, 2506970.

11:30-12:00, April 19, 2026 **Grand Ballroom**

Alice Zhang

Peking University, China

Biography

Dr. Zhang is a pioneer and world leader for her outstanding research achievements and creativity in micro/nanotechnology. She authored and co-authored 300+ peer reviewed scientific articles on the prestigious journals. Dr. Zhang is the founder iCAN and iCANX Talks. she won numbers of Awards/Honors, including won National Invention Award of Science & Technology at 2006, Education Award at 2013 and 2017 in Beijing City, Geneva Invention Gold Medal at 2014. She was honored as the Excellence Teachers in Beijing City at 2017, Top10 supervisors in Peking University at 2017. She won the Medal of May Day in 2018. She won the 2nd prize of National Education Award 2018 and elected as the member of Innovation Education Committee in Chinese Ministry of Education at 2018. She was listed in Forbes Top 50 Female Scientists at China in 2020, Nano Energy Award 2021. 2022-2024 Elsevier Most Cited Chinese Researchers, and 2023-2025 IEEE Distinguish Lecturer.

Plenary Speech

" iCANX Connect the World, Drive the Future"

Abstract: Since April 17th 2020, a new Science platform, iCANX, was initiated, it became the largest online science talk series in last 6 years, 3300+ scientists from 126 countries and regions have delivered their talks on iCANX Stage, 600million viewers from each corner of the world has been benefited. In this talk, iCANX founder, Prof. Haixia (Alice) Zhang will review this 6 years journey, more over, she will talk about the future of iCANX, what's going on for next 10 years, including, iCANX Talks, iCANX Space, iCANX Fund and iCANX Summit.

Technical Sessions

D2-PM-A01: Micro/Nano Energy Devices and Self-Powered Systems

13:30-15:30, April 18, 2026 **Meeting Room 301A**

Session Chair: Xiuhan Li, Beijing Jiaotong University

Invited Speaker

13:30-13:50 **Weiguan Zhang**

Sun Yat-sen University

Bio: Weiguan Zhang is currently an Associate Professor at Sun Yat-sen University (SYSU). He received the Ph.D. degree in Electronic Engineering from City University of Hong Kong in 2014. Then, he worked as a research associate in The Hong Kong University of Science and Technology and City University of Hong Kong. Before joining SYSU, he served as an associate research fellow at Shenzhen University (Guangdong Laboratory of Artificial Intelligence and Digital Economy (SZ)). His research interest includes flexible electronics, micro/nano sensors, and their applications for human-machine interactions. He has published more than 30 papers in international journals and conferences, and authorized 5 invention patents. His research has been funded by both National Natural Science Foundation of China and Guangdong Natural Science Foundation.

Title: Flexible Multimodal Sensory Systems Integrating Self-Powered Active Sensing for Human-Machine Interaction

Abstract: Advanced human-machine interaction requires flexible electronic skins that go beyond simple pressure detection to achieve complex, multimodal perception. This talk explores sensory systems that integrate self-powered active sensing with touchless proximity detection. By combining structural innovations with hybrid mechanisms, these systems can distinguish intricate mechanical stimuli and recognize objects with high precision. Finally, we demonstrate fusing these multimodal signals with Large Language Models, serving as a promising pathway toward the realization of embodied intelligence.

Invited Speaker

13:50-14:10 **Ziya Wang**

Shenzhen University

Bio: Ziya Wang, Assistant Professor/Specially Appointed Associate Researcher, College of Physics and Optoelectronic Engineering, Shenzhen University. Her current research focuses on the mechanisms of multi-modal flexible perception and device design, as well as their applications in general-purpose humanoid robots and specialized robots. She has published over 30 papers as the first or corresponding author, with over 2,000 citations on Google Scholar and an H-index of 21.

Title: A Triboelectric Aero-Field Sensor Enables Cross-Scale Multi-Parameter Sensing in Meter-Scale Flapping-Wing Aircraft

Abstract: Accurate in-situ sensing of unsteady aerodynamics is essential yet highly challenging for closed-loop control in biomimetic meter-scale flapping-wing aircraft. This task demands the capture of three coupled parameters—local wind speed, angle-of-attack, and flapping frequency. Herein, we report a conformal triboelectric aero-field sensor that transduces airflow into aeroelastic vibration induced signals precisely. A low-damping, apertured cantilever design ensures a broad sensing range and rich signal features, enabling accurate decoding of parameters via a deep-learning model (mean absolute errors of 0.11 m •s⁻ 1, 0.10° , and 0.08 Hz). To bridge the Reynolds number gap across scales, we employ a transfer learning strategy, creating a unified model that generalizes from small-scale to full-scale tunnel tests. Outdoor flight tests verified the reconstructed parameters, and the predicted variation trends aligned well with the underlying aircraft maneuvers. This study provides a scalable framework for biomimetic airflow sensing system and establishes a basis for implementing closed-loop flight control.

Invited Speaker

14:10-14:30

Tingting Yang

Southwest Jiaotong University

Bio: Tingting Yang is currently an associate professor at Southwest Jiaotong University (SWJTU). She received her Ph.D. in Materials Science and Engineering from Tsinghua University in 2017. She has been awarded the titles of "Young Eagle Scholar" and "Rising Star of Science and Technology" by SWJTU. Her research areas cover the design and fabrication of interfaces for micro- and nano-functional devices, with a particular focus on moisture-based power generation devices and tactile sensors with confined space ion-electron coupling transport.

She has published one academic monograph, over 40 peer-reviewed papers as corresponding/first author (including 4 in Nature Communications, 4 in Advanced Functional Materials, and 2 in Sensors and Actuators B, etc.), and presented at over 10 conferences (including TRANSDUCERS, NEMS, and the Young Tribologists Conference). She holds over 10 invention patents and serves as a reviewer for several well-known journals (such as Nature Sensors, Nature Sustainability, Nature Reviews Clean Technology, Nature Communications, Advanced Materials, Materials Today, etc.)

Title: Nanofluid Confined Space Design for High-Performance Moisture-Based Power Generation Devices

Abstract: To meet the demand for sustainable power in off-grid micro/nano devices, humidity-based energy harvesting has emerged. Although nanochannel structures are promising for moisture-electric conversion, the dynamic behavior of ions and water within the electrical double layer (EDL) during solid-liquid interaction remains difficult to control, resulting in low output power and short operational lifetimes. To address the power bottleneck, several strategies were proposed: constructing PN junction nanochannels to promote asymmetric charge transfer and directional ion transport; designing hierarchical porous structures to precisely regulate charge density in the diffusion layer; achieving adaptive

regulation of EDL charge and pore size in response to external humidity; and applying the Hofmeister (salting-out) effect to enhance ionic conductivity, selectivity, and structural stability. To overcome lifespan limitations, this study proposes photocatalytic ion gradient reconstruction for migration recovery, humidity fluctuation-induced alternating adsorption/desorption for continuous output, and a photo-humidity dual-driven generator based on asymmetric redox design in hygroscopic hydrogels. To promote practical applications, a cross-scale, large-area manufacturing technique compatible with printing processes was developed, enabling customizable mW-level power output. The feasibility of powering wireless sensor nodes and constructing self-powered sensors was also demonstrated.

Invited Speaker

14:30-14:50

Rusen Yang

Xidian University

Bio: Dr. Rusen Yang is a professor of the School of Physics in Xidian University in China and a fellow of the Royal Society of Chemistry. He obtained his M.S. and B.S. in Condensed Matter Physics from Jilin University, China. In 2007, he received his PhD degree in Materials Science and Engineering from Georgia Institute of Technology, where he continued as Post-Doctoral Associate till 2010. From 2010 to 2018 he worked as an assistant professor in the Department of Mechanical Engineering at the University of Minnesota where he was elected as a McKnight Land Grant Professor in 2013. He has focused his research on bio-inspired functional materials and energy harvesting technology. He has developed new processes to achieve nanowires with controlled orientation and post-growth approaches to align nanostructures. He has created piezoelectric biomaterials with controlled polarization and applied them for energy harvesting. He has published over 160 papers in peer-reviewed journals. His transformative work won him NSF Career Award, 3M NFTA Award, and Nano Energy Award.

Title: Self-assemblies of Piezoelectric Metabolites and Their Energy Harvesting Applications

Abstract: Piezoelectric metabolite materials have received increasing attention in recent years owing to their inherent biological nature and efficient energy conversion capability, and piezoelectric metabolite self-assemblies are considered as promising smart materials for energy, sensor, robotics, healthcare, and many other areas. Rational material design is important to enhance their piezoelectric and biological activity. Herein, recent advancements to piezoelectric biomaterials, such as amino acids and peptide-based micro/nanostructures, are provided. Synthetic methods, morphological features, and piezoelectric performance of piezoelectric biomaterials are presented. The effect of growth direction, phase and structure of piezoelectric biomaterials on their piezoelectric activity are discussed. The applications of piezoelectric biomaterials in the field of nanogenerators are provided at the end.

Invited Speaker

14:50-15:10

Yujia Zhang

École Polytechnique Fédérale de Lausanne (EPFL)

Bio: Prof. Yujia Zhang is a Tenure Track Assistant Professor of Electrical and Micro Engineering at the School of Engineering, École Polytechnique Fédérale de Lausanne (EPFL). He has led the Laboratory for Bio-Iontronics (BION) since 2025. A major interest of his laboratory is the development of iontronic biointerfaces for medicine and hybrid intelligent systems. Recently, he has pioneered dropletronics, in which networks of microscale soft droplets function as versatile bioiontronic/bioelectronic devices. Prior to his appointment, he obtained his B.Sc. in Electronics Engineering from the University of Science and Technology of China (USTC) in 2016. Later, he completed his PhD in biomedical engineering and MEMS/NEMS technology at the Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS), followed by one year as a visiting PhD student at Stony Brook University in the US. In 2021, Yujia joined the Bayley group at the University of Oxford, UK, and in 2023, he became an independent early-career research fellow hosted in the Department of Chemistry at the University of Oxford. Yujia has published over 40 peer-reviewed journal articles and conference proceedings, including Nature (2023), Science (2024), etc. Yujia also serves as a reviewer and guest editor for several scientific journals, including Nature Materials, Nature Electronics, Science Advances, and Iontronics. Meanwhile, he is an active member of the Royal Society of Chemistry and the International Society of Bionic Engineering. Yujia is the recipient of many prestigious national and international awards, including the Special Prize of President Scholarship for Postgraduate Students, CAS (2020), the Early-career Scientist Representative by the UK Parliamentary and Scientific Committee (2023), and the Young Scientist Award by the iCANX Global Summit (2025).

Title: Dropletronics for Microscale Modular Multifunctional (M3) Biointerfaces

Abstract: Hydrogel iontronic devices can emulate biological functions and communicate with living matter. However, the fabrication of miniature, soft iontronic devices according to modular designs has not been achieved. In the talk, I will discuss the use of surfactant-supported assembly of freestanding microscale hydrogel droplets, termed dropletronics, to construct various ionic power sources, iontronic modules, circuits, and biointerfaces. The tiny, versatile dropletronic devices enable a variety of biomedical applications, including modulation of human brain organoids, defibrillation and pacing of mouse hearts, and recording electrophysiological signals from sheets of human cardiomyocytes. I will also introduce some ongoing projects in my group, Laboratory for Bio-Iontronics (BION) at EPFL, and conclude by summarising the major challenges in the field and future directions.

Invited Speaker

15:10-15:30

Haiwu Zheng

Henan University

Bio: Haiwu Zheng received his Ph.D. degree from the University of Science and Technology of China in 2006. He then joined the School of Physics and Electronics of Henan University. Professor Zheng has been appointed a specially-appointed professor in Henan Province since 2020 and has been approved as Zhongyuan Elite Program (Nurturing Talent Series) -Zhongyuan Leading Talent in Basic Research since 2024. In 2024, Zheng Haiwu was rated as a second-class professor in Henan Province. Currently, Prof. Zheng is the director of the Henan Provincial Engineering Research Center for Intelligent Micro-Nano Sensing Technology and Application. His research direction is about self-powered intelligent sensing microsystems based on optoelectronic information devices and micro-energy devices based on nanogenerators.

Title: Energy Harvesting Devices Based on Two-Dimensional Piezoelectric Materials and Their Intelligent Sensing Applications

Abstract: This report mainly introduces the progress made by my research group in the past three years in the field of energy harvesting devices based on two-dimensional piezoelectric materials and their sensing applications. (1) Ferroelectric polarization can significantly enhance the electrical output performance of CuInP2S6(CIPS) piezoelectric nanogenerators. The effects of ferroelectric polarization on the ferroelectric polarization switching behavior and piezoelectric performance of CIPS were investigated by piezoelectric response force microscopy and confocal Raman microscopy, and the in-plane migration and out-of-plane jumping of copper ions were observed. PENG based on CIPS can be attached to the human body to collect the energy of biological movement. Combined with deep learning technology, it can realize an intelligent voice recognition system, providing technical guidance for the development of nanoelectronic devices with intelligent sensing functions. (2) The piezoelectric performance of flexible Bi2O2Se PENG was introduced, and the human pulse signal was monitored by using it. A self-powered pulse monitoring system was constructed. Finally, the early diagnosis of nine common cardiovascular diseases was achieved with the help of deep learning. This work provides a new idea for the development of intelligent medical devices based on self-powered technology.

Technical Sessions

D2-PM-A02: Flexible Functional Materials and Devices

13:30-15:40, April 18, 2026 **Meeting Room 301B**

Session Chair: Xinqin Liao, Xiamen University

Keynote Speaker

13:30-14:00 **Mingsheng Xu**

Shandong University

Bio: Mingsheng Xu is currently a Professor at University of Shandong University. He received the Ph.D. degree in Materials science from Shandong University in 2014. And then he joined South China University of Teconology, as a post-doctor. In 2017, he was associated professor of Shandong University.

Prof. Xu is awarded National High-Level Young Talent, Taishan Scholar Distinguished Expert of Shandong Province. He is primarily engaged in the research of wide-bandgap semiconductor thin-film growth and optoelectronic device fabrication. He has published over 40 papers indexed by SCI/EI, been granted nearly 20 invention and utility model patents, and led multiple scientific research projects, including the National Natural Science Foundation of China, General and Special Funded Projects of the China Postdoctoral Science Foundation, and Key Research and Development Program of the Province.

Title: Recent Research Progress of SiC-Based Devices

Abstract: Low-thermal-damage SiC ohmic contact study by surface modification and laser annealing

Invited Speaker

14:00-14:20 **Xiangyu Chen**

Beijing Institute of nanoenergy and nanosystems, Chinese Academic of Sciences

Bio: Dr. Xiangyu Chen is a professor in Beijing Institute of nanoenergy and nanosystems, Chinese Academic of Sciences. He received his B.S. degree in Electrical Engineering from Tsinghua university in 2007 and his Ph.D. degree in Electronics Physics from Tokyo Institute of Technology in 2013. His research interests are mainly focused on self-powered nano system, smart materials, microfluidics systems and the nonlinear optical system for characterizing the electrical properties of the devices. He has been awarded by National Natural Science Foundation of China for Distinguished Young Scholar, Beijing overseas talent sea gathering project and selected as Specially-invited Expert of Beijing. He has also

been selected by the Beijing Youth top talent support program. Dr. Xiangyu Chen been granted many funds with a total amount over 15 million RMB, including National Natural Science Foundation of China, Ministry of science and technology of China and Natural Science Foundation of Beijing. He has published more than 40 scientific papers as first author or corresponding author. Most of those papers are published on the top level journals, such as Chemical reviews, Science advances, Nature Communications, Advanced Materials, Materials Today and so on.

Title: Triboelectric Polymer and Self-Powered Sensors

Abstract: The development of micro nano scale energy systems that collect energy from the surrounding environment and achieve multifunctional self-powered sensing has important practical value. Triboelectric and piezoelectric technology are similar, both of which achieve active sensing and energy generation through specific force electricity conversion mechanisms. This report focuses on the micro energy and functional sensing achieved by frictional power generation technology, with a focus on the research of self-powered micro-nano systems and wearable intelligent devices. We explain the atomic scale electron transfer phenomenon during contact electrification based on the physical model of electron cloud overlap and quantum potential wells, reveal the mechanism of the molecular structure and functional group composition of polymer materials on contact electrification, and propose a complete processing technology and modification method for preparing high-performance triboelectric polymers. Finally, we have achieved the highest surface charge density thin film electrification material currently available and prepared high output characteristic micro energy devices. Based on our previous research on piezoelectric ceramic actuators, we have extended the study of frictional electricity to areas such as plastic films and dielectric elastomer materials, virtual reality, and augmented reality technology for self-powered functional systems. We have achieved a series of novel applications in flexible sensing systems, biomimetic muscles, and other fields.

Invited Speaker

14:20-14:40

Lin Xu

Jilin University

Bio: Xu Lin is a Tang Aoqing Leading Professor at Jilin University and a recipient of the National Young Talent Program. She has been honored as a National Outstanding Postdoctoral Fellow in Innovation and Entrepreneurship and a Distinguished Contribution Expert of Jilin Province. She serves as a young editorial board member for Nano-Micro Letters, The Innovation, and Moore and More. Her research focuses on advanced sensing (biological and gas sensing) and optoelectronic devices and their applications, with an emphasis on the development of high-performance sensitive materials and optoelectronic devices. She has published over 190 papers in international academic journals such as Advanced Materials, Chemical Society Reviews, Advanced Energy Materials, and etc., which have received more than 10500 citations, with an H-index of 65. As a principal investigator, she has led more than 12 provincial and ministerial-level projects, including

General Programs and Young Scientist Programs of the National Natural Science Foundation of China. She has delivered over 30 invited presentations at international and domestic academic conferences. She was awarded the First Prize for Natural Science by Jilin Province in 2019 and the First Prize for Science and Technology Progress by Jilin Province in 2023.

Title: Multimodal Sensing Platforms For Intelligent Health Monitoring

Abstract: The rapid development of integrated and intelligent electronic technologies has brought revolutionary transformations to remote healthcare and environmental monitoring, greatly advancing the realization of non-invasive information acquisition and real-time tracking. By highly integrating sensors, data processing modules, and wireless communication technologies, modern electronic systems enable precise acquisition and real-time transmission of key information such as physiological signals and environmental parameters. These technological advances not only improve monitoring efficiency but also reduce the need for manual intervention, providing strong support for smart healthcare and intelligent environmental management. This report focuses on the functional design of micro/nano-integrated sensors based on low-dimensional sensitive materials and explores their applications across multiple fields. In breath analysis, semiconductor sensors fabricated via micro/nanoprocessing techniques are investigated for highly sensitive detection of trace gas molecules. In addition, integrated biosensor designs are employed to detect specific biomarkers in body fluids, enabling early disease screening and real-time monitoring. In the domain of smart agriculture, micro/nano sensor networks are explored for comprehensive monitoring of farmland environments.

Invited Speaker

14:40-15:00

Chaoxing Wu

Fuzhou University

Bio: Prof. Chaoxing Wu is a Professor and Doctoral Supervisor at the College of Physics and Information Engineering, Fuzhou University. He also serves as Deputy Director of the National and Local Joint Engineering Research Center for Flat Panel Display Technology, and leads project teams at Fujian Mindu Innovation Laboratory. Having obtained his Doctoral (Physical Electronics) degrees from Fuzhou University, Prof. Wu conducted research at Hanyang University in South Korea (2015-2018) with support from BK21 and KRF. He joined Fuzhou University as a full Professor directly in 2019.

His main research focuses on future electronic and display technologies, particularly micro-nano LED displays (Micro-LED, NLED) and non-carrier-injection electroluminescence (NCI-EL). As a principal investigator, he undertakes major national R&D projects and NSFC programs. He has published over 40 papers with IF > 10 (including Nature Sensors, Nature Communications, Advanced Materials) as first/corresponding author, with total citations exceeding 8,000, and holds multiple patents in China, the US, and South Korea.

Title: Non-Carrier-Injection Electroluminescence

Abstract: Non-carrier-injection electroluminescence (NCI-EL) uses an AC electric field and displacement current to activate internal charge reservoirs and drive radiative recombination, enabling light emission without steady-state carrier injection or strict ohmic-contact requirements. This talk summarizes NCI-EL from device/circuit excitation to carrier-level processes, and clarifies its connections and differences with photoluminescence and mechanoluminescence. I will compare representative emissive materials, including organic/polymeric AC-EL systems, wide-bandgap semiconductors, colloidal quantum dots, and 2D transition-metal dichalcogenides, and organize mainstream device configurations into planar non-injection, interdigital-electrode, single-terminal, and coaxial architectures. Application advances are demonstrated in micro-/nano-displays, nondestructive inspection and sensing, and optical information transmission and neuromorphic functions enabled by waveform programmability and history-dependent emission. I will further propose a unified design framework based on charge source, spatial distribution, time scales, and driving waveform, and discuss key challenges in voltage/efficiency, reliability, multiscale modeling, and manufacturing compatibility.

Invited Speaker

15:00-15:20

Xiaojian Zhu

Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences

Bio: Xiaojian Zhu is a Full Professor at the Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences. He received his Ph.D. in Materials Science from the University of Chinese Academy of Sciences (UCAS) in 2014. From 2015 to 2020, He worked as a postdoctoral at the University of Michigan, Ann Arbor, USA. He joined the Ningbo Institute of Materials Technology and Engineering in 2020. His research interests include nanoionic materials and devices, with applications in neuromorphic computing. Prof. Zhu has published over 80 SCI-indexed papers in journals including Nature Materials, Advanced Materials, ACS Nano and Nano Letters, with more than 5,000 total citations. He has received several awards, including the Second Prize of Science and Technology by the Chinese Institute of Electronics (CIE), the First Prize of Natural Science of Zhejiang Province, and the President's Award for Excellence of the Chinese Academy of Sciences. He has led a number of research projects as principal investigator, supported by the National Natural Science Foundation of China (NSFC), the Zhejiang Provincial Natural Science Foundation, and the Chinese Academy of Sciences (CAS). He also serves as a Member of the New Materials Expert Committee of the Zhejiang Youth High-Level Talent Association and a reviewer for journals including Nature Electronics etc.

Title: Nanoionics Enabled Neuromorphic Materials and Devices for Intelligent Information Processing

Abstract: The rapid advancement of artificial intelligence technologies has created an urgent demand for high-density information storage and low-power data processing. Neuromorphic devices, engineered to

mimic the storage and computational mechanisms of biological neurons, offer inherent advantages such as compact size, high speed, and facile integration. These devices typically leverage nanoionic semiconductor materials as functional media, where electric fields govern ion distribution and tune conductance states to enable information storage and computation. However, the lack of effective strategies for precisely regulating ion distribution and conductance states has led to poor operational stability, which in turn limits progress in this field. This presentation outlines several strategies for manipulating nanoscale ion migration and distribution, achieving stable, multi-level, and cumulative regulation of conductance states, alongside the development of high performance neuromorphic devices. These findings provide valuable guidelines for advancing neuromorphic chips and artificial intelligence technologies.

Invited Speaker

15:20-15:40

Li Yang

Hebei University of Technology

Bio: Li Yang is currently a Professor at Hebei University of Technology. She received the Ph.D. degree in Mechanical Engineering from Hebei University of Technology in 2015. She was awarded with the Leading Talent of the Yanzhao Golden Stage Talent Gathering Program by the Hebei Provincial Party Committee. She received the Second Class Prize of the Tianjin Natural Science Award (ranking first). Her research field covers laser direct-writing manufacturing technology and flexible wearable electronic devices, and especially their application for biomedical engineering. Prof. Yang has published more than 60 peer-reviewed papers (Nature Communications, Advanced Materials, Nano Letters, etc.), among which 5 are ESI Highly Cited Papers, and authorized 20 invention patents.

Title: Flexible Sensing System for Decoupled Multimodal Health Monitoring

Abstract: Biomedical and wearable technologies are among the key technologies for the transformation and upgrading of the healthcare and health industry. Flexible wearable sensing systems can achieve conformal attachment and adaptive deformation with the human body and biological tissues, and are crucial for realizing convenient, comfortable, and real-time human health monitoring. They have significant application profspects in life sciences and medicine. This report will focus on the latest research achievements of the research group's flexible sensing technology in the field of wearable bioelectronics and health monitoring. A series of achievements have been published in journals such as Nature Communications, Advanced Materials, Advanced Science, and Nano Letters. It introduces the laser direct writing manufacturing technology of multi-functional flexible sensors, the multi-modal decoupling mechanism, and the constructed flexible sensing systems (gas, pressure, temperature, humidity, electrochemical sensors, etc.) for the application of physiological information health monitoring and disease diagnosis.

Technical Sessions

D2-PM-A03: Micro/Nano Sensing-Memory-Computing Devices

13:30-15:30, April 18, 2026 **Meeting Room 301C**

Session Chair: Rui Yang, Shanghai Jiao Tong University

Keynote Speaker

13:30-14:00

Jianlu Wang

Fudan University

Bio: Jianlu Wang is currently a professor at Fudan University, Vice Dean of College of Integrated Circuits and Micro-Nano Electronics /Institute of Optoelectronics. He received the Ph.D. degree in Microelectronics and Solid-State Electronics from Shanghai Institute of Technical Physics, Chinese Academy of Sciences in 2010. From 2010-2021, he worked in Shanghai Institute of Technical Physics, Chinese Academy of Sciences as a assistant professor, associate professor and professor respectively. His research is focus on optoelectronic sensing devices and related chips. Has served as principal investigator for over 10 national-level projects, including the National Key Research and Develop Program and Key Programs of the National Natural Science Foundation of China. He has published more than 100 papers in journals such as Nature Electronics and Nature Materials, and holds over 30 authorized Chinese invention patents and 4 U.S. invention patents. Invited to deliver presentations at over 40 domestic and international conferences. Serves as Associate Editor of Materials Today Electronics and Journal of Infrared and Millimeter Waves, Editorial Board Member of Nanotechnology, and Laser & Optoelectronics Progress.

Title: Ferroelectric-Based Neuromorphic Devices for Bio-Inspired Computing

Abstract: The growing gap between the rapidly increasing demand for computing power and the slowing improvements in computing speed is becoming more noticeable within the von Neumann architecture. Ferroelectric materials, such as hafnium-based ferroelectrics and two-dimensional van der Waals ferroelectrics, are promising for neuromorphic computing because the partial ferroelectric domain switching behavior can emulate the temporal dynamics of biological neurons and synapses. Because ferroelectric devices are driven by electric fields, their writing energy is much lower than that of other efficient materials used for memory, such as phase change memory and resistive random-access memory. In this talk, we discuss the advances in ferroelectric neuromorphic devices and arrays, and their in-sensor applications. We summarize the device structure and principles of ferroelectric synaptic devices and neuronal circuits. Furthermore, we emphasize the key role of ferroelectric devices in building efficient and scalable synapse and neuron arrays, including topologies of various structures, the potential for more physical domain computing and high-density 3D integration. Finally, we discuss ferroelectric materials as a

key component in supporting workloads that are unattainable using complementary metal-oxide semiconductor -based memory technology.

Keynote Speaker

14:00-14:30

Xingsheng Wang

Huazhong University of Science and Technology

Bio: Xingsheng Wang obtained his Ph.D. from the University of Glasgow, UK, in 2010, later he worked in Synopsys as senior engineer and he joined Huazhong University of Science and Technology (HUST) as a full professor in 2018. Prof. Wang focuses on the research of Design – Technology Co-Optimization (DTCO) EDA and novel computing-in-memory chip technologies. He has published over a hundred papers in leading IEEE journals and conferences such as IEEE EDL, TED, ISCAS, DAC, ICCAD, and IRPS. He holds more than ten major research projects, including key projects from NSFC and National Key R&D Program, also joint research projects with YMTC, and Huawei. He serves as TPC sub-committee chairs or members of IEEE ISEDA and ICTA, DAC and ETDM. He is a senior member of IEEE, CCF, and CAAI. He received the 2022 Huawei OlympusMons Pioneer Award.

Title: Memristor-based Computing-in-Memory Chip Co-Design for Edge AI

Abstract: Analog matrix multiplication based on memristor crossbar arrays can significantly increase computational throughput and energy efficiency. However, its physical implementation faces several fundamental challenges, including unclear device dynamics, reliability issues in multilevel operation, and IR-drop of the array. To address these issues, we fabricated CMOS-compatible memristor array chips based on 180 nm and 55 nm processes and developed a 3D multi-physics device simulator and crossbar array simulators. This enabled us to clarify the conductive filament formation and rupture mechanism in memristors, as well as the random telegraph signal (RTS) mechanism affecting read current reliability. We also developed superlattice-like memristors to achieve stable multilevel characteristics. For the critical issue of crossbar IR-drop, which severely impacts computational accuracy and throughput, we implemented a fast and accurate modeling method with O(n) complexity. Through co-optimization of layout and circuit design, along with a proposed real-time deployment correction approach, we substantially increased the scale of a single multiply-accumulate core to several megabits. These advances systematically overcome the bottleneck of array scaling, significantly improving both computational performance and energy efficiency of memristor computing-in-memory chips.

Invited Speaker

14:30-14:50

Luming Wang

University of Electronic Science and Technology of China

Bio: Luming Wang is completing his Ph.D. at the Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, and will shortly join East China Normal University as a research associate professor.

His work on nanoelectromechanical resonators spans precision measurement, device physics, advanced sensing, and post-Moore nanomechanical computing devices. He has authored first-author papers in journals including *Advanced Science*, *National Science Review*, *InfoMat*, *International Journal of Extreme Manufacturing* and *Applied Physics Review*. He also serves as an Early Career Researcher reviewer for *Nature Communications*.

At the previous *IEEE NEMS 2025*, he received the Best Conference Paper Award — the sole top-tier recognition granted.

Title: NEMS-Based Sensing Using Two-Dimensional Non-Layered Materials

Abstract: Two-dimensional (2D) non-layered materials, along with their unique surface properties, offer intriguing prospects for sensing applications. Introducing mechanical degrees of freedom is expected to enrich the sensing performances of 2D non-layered devices, such as high frequency, high tunability, and large dynamic range, which could lead to new types of high performance nanosensors.

Here, we demonstrate 2D non-layered nanomechanical resonant sensors based on β-In_2S_3, where the devices exhibit robust nanomechanical vibrations up to the very high frequency (VHF) band. We show that such device can operate as pressure sensor over a broad range (from 10-3 Torr to atmospheric pressure), high linearity (with a nonlinearity factor as low as 0.0071), and fast response (with an intrinsic response time less than 1 μs). We further demonstrate a NEMS-based two-degrees-of-freedom (DOF) approach, which allows the simultaneous extraction of the thermal conductivity of β-In_2S_3 and the interfacial thermal conductance at the β-In_2S_3/SiO_2 interface. We find that the unusual thermal conductivity of β-In_2S_3 directly translates into an exceptional power-to-frequency responsivity of the β-In_2S_3 resonator, achieving −447 ppm/μW at 532 nm, representing the highest performance among reported drumhead NEMS-based bolometers. Our work paves the way towards future wafer-scale design and integrated sensors based on 2D non-layered materials.

Invited Speaker

14:50-15:10

Chuanyu Han

Xi'an Jiaotong University

Bio: Chuanyu Han is currently an Associate Professor with tenure at Xi ' an Jiaotong University (XJTU). He received his Ph.D. degree in Microelectronics from the University of Hong Kong in 2015. Following his doctoral studies, he worked as a Research Scientist at the Hong Kong Polytechnic University. In 2016, he joined Xi ' an Jiaotong University as an Assistant Professor and was promoted to tenured Associate Professor in 2021. His research interests include neuromorphic devices and sensing systems, memristors, thin-film transistors, bioelectronic sensors, spiking neural networks, and their hardware implementations.

Assoc. Prof. Han has published more than 90 peer-reviewed papers in journals including IEEE Electron Device Letters, Applied Physics Letters , ACS Sensors, and Nano Research. He has delivered over 10 conference presentations and is an inventor on more than 10 authorized invention patents. He has presided over 1 National Natural Science Foundation of China (NSFC) Young Scientist Program and 2 NSFC General Programs. He currently serves on the Young Editorial Board of Medical Gas Research and Journal of Nanotechnology and Smart Materials.

Title: Neuromorphic Sensing System Based on Threshold-Switching Memristor

Abstract: The recent surge of interest in cutting-edge artificial intelligence has stimulated considerable research attention toward neuromorphic computing and sensing, which emulate the functions of biological neural systems. Artificial spiking neurons serve as critical components in neuromorphic systems. Threshold-switching memristors based on NbOx and VOx Mott insulators can generate stable oscillating electrical spikes in a single device with a simple sandwich structure, thus facilitating the emulation of biological neurons. This presentation will introduce our research achievements in neuromorphic sensing systems based on threshold-switching memristors, including device structure and electrical characteristics, neuromorphic sensing architecture, and hardware implementation.

Invited Speaker

15:10-15:30

Linfeng Sun

Beijing Institute of Technology

Bio: Dr./Prof. Sun Linfeng is the Xu Teli Endowed Young Scholar at Beijing Institute of Technology (BIT), and the Director of the Laboratory of Quantum Intelligent Materials and Devices. Before joining BIT, he spent 4 years at Sungkyunkwan University, South Korea as a Research Professor Supported by Korean Research Fellowship. He received his Ph.D. in Applied Physics in 2016 from Nanyang Technological University, Singapore. Prof Sun's research interests include 2D memristor for Neuromorphic Computing with applications in edge computing. He has received several prestigious awards, including Korean Research

Fellowship (KRF), China's Rising Stars in Science and Technology, Beijing Municipal Natural Science Award (Ranked 1st), and Recipient of the Gold Award, China Association of Inventions National Exhibition (Ranked 1st).

Prof. Sun has served on the academic/technical committees or co-chair of major conferences, such as the 3rdWMC/9thWMS/IUMRS-ICA2025| International Conference, IEEE International Conference on Signal, Information and Data Processing, etc. Currently, he leads the National Key Research and Development Program, Key Program of Beijing Natural Science Foundation, National Natural Science Foundation of China, etc., and serves as the reviewer for Nature Electronics, Nature Materials, Nature Communications, Science Advances, Advanced Materials, Nano Letters, etc.

Title: 2D Memristors for In-sensor Neuromorphic Computing

Abstract: The von Neumann separation of sensing, memory, and processing incurs costly data movement, creating major energy and latency bottlenecks for data-intensive edge-vision workloads. Van der Waals 2D materials, featuring atomic-scale thickness and clean interfaces, enable strong electrostatic gating and stably programmable conductance modulation within a single device, thereby engineering interfacial, defect, and polarization dynamics into neuromorphic primitives such as memory, nonlinearity, and temporal states for in-sensor computing. This talk will present our recent progress on 2D memristors for in-sensor neuromorphic computing. Through polarization engineering as well as defect and interfacial modulation, we develop neuromorphic devices that implement synaptic plasticity, rich temporal dynamics, and nonlinear activation function. These capabilities enable in-sensor computing, whose performance is further validated on vision-related tasks.

Technical Sessions

D2-PM-A04: Micro/Nano Integrated Devices and Circuit Design

13:30-15:20, April 18, 2026 **Meeting Room 302A**

Session Chair: Zhuoqing Yang, Shanghai Jiao Tong University

Keynote Speaker

13:30-14:00 **Junshan Liu**

Dalian University of Technology

Bio: Junshan Liu is the director of Key Laboratory for Micro/Nano Technology and System of Liaoning Province, School of Mechanical Engineering, Dalian University of Technology. His research interests include polymer micro/nano fabrication technologies, microfluidics and soft electronics. He is an editorial board member of the Chinese Journal of Mechanical Engineering, Chinese Journal of Scientific Instrument and Journal of Transduction Technology. He is a council member and deputy secretary-general of the Chinese Society of Micro-Nano Technology, a vice-chairman and deputy secretary-general of Micro-Nano Manufacturing Technology Branch of Chinese Mechanical Engineering Society, a council member and deputy secretary-general of the National Intelligent Sensor Innovation Alliance, and the member of the National Microelectromechanical Technology Standardization Technical Committee.

Title: Reconfigurable Liquid Crystal Elastomer Structures and Their Applications

Abstract: The large, reversible shape morphing of liquid crystal elastomers (LCEs), which results from the coupling between the liquid crystal (LC) mesogen orientation and the polymer network deformation, has attracted much attention for soft robotics and biomedical devices. From well-controlled LC mesogen alignment to tunable macroscopic shape morphing, this talk presents an integrative design framework for reconfigurable LCE structures. Through mechanical buckling, spatially aligned LC mesogens are tailored to construct diverse reversible reconfigurations. Selective photopolymerization allows manipulation of crosslinking densities for heterogeneous stiffness distributions and sequential shape morphing. Integration of thermochromic dyes and ferromagnetic particles further imparts simultaneous shape switching and color changing capabilities, together with multimodal locomotion. Innovative biomedical applications are demonstrated, including a closed loop adaptive pressure therapy bandage for dynamic pressure management in burn treatment and a vascular tunneling robot for thrombus simulator disruption and retrieval in a cerebral artery model.

Invited Speaker

14:00-14:20

Kai Tao

Northwestern Polytechnical University

Bio: Professor Kai Tao is a faculty member in the School of Mechanical Engineering at Northwestern Polytechnical University. Since February 2017, he has been leading a research team in the Department of Microsystem Engineering at Northwestern Polytechnical University. His research interests revolve around the fabrication of NEMS/MEMS, energy harvesting and self-powered MEMS devices. He has published over 100 papers and has been cited over 10000 times with an H-index of 55, according to Google Scholar. 23 of his papers have been recognized as highly cited papers or hot papers (Web of Science ESI). He was selected for the National Youth Talent Program and listed in the World's Top 2% Scientists by Stanford (2022-2025, top 0.5% in 2025). He also serves as an editor for several international journals and a general/session chair for IEEE INEC, IEEE/ASME AIM, and VEH (2021-2023) international conferences.

Title: Micro Vibration Energy Harvesting and Self-powered Sensing

Abstract: Recent advancements in technology have led to the development of micro-scale energy harvesting technologies, which have the potential to enable self-autonomous devices and intelligent monitoring activities. However, these technologies still face challenges such as narrow bandwidth and low output performance. The report aims to address two key questions: "How can we expand and improve the working frequency of energy harvesting devices?" and "How can we use micro/nano processing technology to enhance output efficiency?" It introduces the mechanism characteristics, manufacturing methods, and device applications, including multi-mode nonlinear frequency expansion theory, a helical gear-clutch frequency-up mechanism, an etch-free micro-charge graphic preparation method, and research on the application of micro/nano energy-harvesting devices in human-machine interaction interfaces and self-powered wireless health monitoring. This may lay the technical foundation for overcoming the practical limitations of micro- and nano-scale energy-harvesting devices.

Invited Speaker

14:20-14:40

Xu Xu

Wuhan University of Technology

Bio: Xu Xu is currently a Professor at the School of Materials and Microelectronics, Wuhan University of Technology. His research focuses on nano energy storage materials and devices, including the design and fabrication of all-solid-state thin-film batteries and in situ characterization techniques. To date, he has published over 100 papers (Advanced Materials, , National Science Review, ACS Nano, Energy & Environmental Science, etc.) and authorized 14 invention patents. His publications have received more than 14,000 citations, with an H-index of 53.

Title: All-Solid-State Thin-Film Batteries for On-Chip Integration

Abstract: Electronic information technology continues to advance toward miniaturization and high integration, ushering the world into the era of the Internet of Things (IoT), where the number of miniature passive electronic devices is rapidly increasing. All-solid-state thin-film batteries, featuring easy integration, heterogeneous assembly capability, and high volumetric energy density, are regarded as an effective solution for energy storage units in microelectronic devices and have gradually become a frontier research hotspot and an important direction for industrial development worldwide. We have developed all-solid-state thin-film batteries using thin-film deposition techniques such as magnetron sputtering and vacuum thermal evaporation. These batteries exhibit excellent interfacial contact and can achieve long cycling stability without the need for external pressure, demonstrating great application potential in fields such as the Internet of Things and microelectronic integration.

Invited Speaker

14:40-15:00

Ding Zhao

Westlake Institute for Optoelectonics

Bio: Ding Zhao received his Ph.D. degree in Optical Engineering from Zhejiang University, China in 2016. He joined Technical University of Denmark as a H.C. Ørsted Postdoctoral Fellow in 2017. He became a research assistant professor and a research associate professor at Westlake University, China in 2020 and 2022, respectively. Since 2023, he joined Westlake Institute for Optoelectonics as a research professor. His research interests include advanced nanolithography and nanopatterning methods.

Title: Cryogenic Electron-Beam Lithography for Optoelectronic Devices

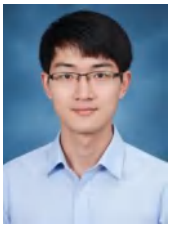
Abstract: Nanotechnology and nanoscience are enabled by nanofabrication. Electron-beam lithography (EBL), which makes 2D patterns down to a few nanometers, is one of the fundamental pillars of nanofabrication. Cryogenic EBL, also known as ice lithography, is a versatile technique, which utilizes condensed gases as resists and performs patterning at cryogenic temperatures. Compared with conventional EBL, cryogenic EBL works better at 3D nanofabrication, especially on nonplanar and fragile substrates. In this talk, current status and future perspectives of cryogenic EBL will be presented. Furthermore, it also covers different ice resists and instrument design. Special emphasis is placed on the application of this method for photonics, electronics and 3D micro/nanodevices for biology.

Invited Speaker

15:00-15:20

Huayang Sai

Peking University



Bio: Sai Huayang is a specially appointed Associate Research Fellow at the School of Advanced Manufacturing and Robotics, Peking University. He has led several research projects, including those funded by the National Natural Science Foundation of China, the China Postdoctoral Science Foundation General Program, and Peking University's Emerging Engineering Initiative. Over the past five years, he has published more than 30 papers and has been granted 11 invention patents. He has received honors including the Boya Postdoctoral Fellowship of Peking University, Category B support from the State-funded Program, and the President's Special Award of the Chinese Academy of Sciences.

Title: Ultrasound-Powered Microgear Transmission

Abstract: Hard-contact mechanical transmission is rarely employed in micromachines because surface forces dominate over inertial forces at small scales, often causing microgears to jam, wear, and fail. In this report, I will present an ultrasound-powered microgear platform that uses acoustic streaming to achieve robust and reliable microscale mechanical transmission. Sharp-edged acoustic micropropellers integrated onto a 75 μm gear efficiently convert ultrasound energy into driving torque, enabling stable rotation by overcoming friction and viscous drag. Experiments show that the microgears can rotate at speeds exceeding 500 rpm with negligible wear during hours of continuous operation. Owing to its modular design, this platform can be readily extended to different gear configurations and functional micromachines. Using this strategy, several transmission-driven microsystems have been demonstrated, including precise two-dimensional epitrochoidal trajectory generation, complex three-dimensional wing-like motion, friction-locked shape morphing, and a compact multi-stage mechanical counter. These functions are difficult to achieve using conventional compliant micromechanisms. Overall, this report highlights a practical route toward microscale hard-contact mechanical transmission and a general platform for encoding complex functions directly into micromachine structures without relying on sophisticated external control. This approach may open opportunities for future applications in implantable medical devices, high-power microrobots, and intelligent microsystems.

Technical Sessions

D2-PM-A05: M/NEMS Resonators

13:30-15:30, April 18, 2026 **Meeting Room 302B**

Session Chair: Guoqiang Wu, Wuhan University

Keynote Speaker

13:30-14:00

Baoyong Chi

Tsinghua University

Bio: Baoyong Chi received the B.S. degree in microelectronics from Peking University, Beijing, China, in 1998, and the Ph.D. degree from Tsinghua University, Beijing, in 2003. From 2006 to 2007, he was a Visiting Assistant Professor with Stanford University, Stanford, CA, USA. He is currently a Full Professor at the School of Integrated Circuits, Tsinghua University, where he also serves as Chair of the Academic Degrees Sub-Committee. His primary research focuses on radio-frequency (RF)/millimeter-wave integrated circuits and RF microsystems for communication and radar. He has been recognized with several prestigious honors, including the National Science Fund for Distinguished Young Scholars from the NSFC and the High-Level Talents from the Ministry of Education. He has published over 200 academic papers.

Prof. Chi has served as TPC Chair of IEEE A-SSCC, Guest Editor for IEEE Journal of Solid-State Circuits (JSSC) and IEEE Transactions on Circuits and Systems II (TCAS-II), and Editorial Board Member of SCIENCE CHINA Information Sciences. As principal investigator, he has led major projects from the NSFC, National High-Tech R&D Program (863 Program), National Science and Technology Major Project, and National Key R&D Program. His awards include the Tsinghua University Academic Newcomer Award, the China Institute of Electronics Outstanding Scientist Award, the Second Prize of Beijing Municipal Science and Technology Progress Award, and the Grand Prize of Tianjin Natural Science Award.

Title: Accuracy-Boosted Temperature Compensated Crystal Oscillator

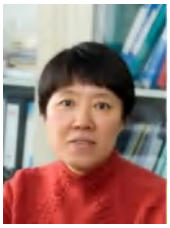
Abstract: Accurate megahertz clocks, typically generated by crystal oscillators (XOs), play a critical role in wireless communication systems. High frequency accuracy could be achieved by the active compensation in the temperature compensated crystal oscillator (TCXO). However, the spectral purity is usually degraded by the noise and distortion from the active compensation. This talk reports a megahertz TCXO featuring a time-domain accuracy boosting scheme to enhance the signal-to-noise and distortion ratio (SNDR) at the oscillator core’s tuning port. The key design considerations and circuit details are discussed. The TXCO is implemented in a 0.18-μm CMOS process, and achieves ±0.6 ppm/±1.4 ppm frequency accuracy over -55◦C to 85◦C/115◦C, corresponding to a 38:6×/13:2× improvement over uncompensated cases while maintaining competitive noise performance compared with existing solutions.

Keynote Speaker

14:00-14:30

Jinling Yang

Institute of Semiconductors, Chinese Academy of Sciences



Bio: Professor Jinling Yang currently serves as a Professor and Doctoral Supervisor at the Institute of Semiconductors, Chinese Academy of Sciences (CAS), and is also a professor at the University of Chinese Academy of Sciences. She received her Ph.D. in Condensed Matter Physics from the Institute of Physics, CAS, in 1997. She subsequently conducted research at Tohoku University (Japan), the University of Freiburg (Germany), and the IBM Zurich Research Lab/University of Basel (Switzerland). In 2004, she was selected for the CAS "Hundred Talents Program" and returned to China to continue her work. Her research focuses on Micro-Electro-Mechanical Systems, particularly the development and application of resonators, oscillators, scanning probes, and so on.

Professor Yang has published 2 scientific books and over 100 peer-reviewed papers, which have been cited more than 2,000 times in prestigious journals including Nature and its sister journals. She was invited to contribute chapters to the Encyclopedia of Nanotechnology and the Handbook of MEMS. She has authorized 1 PCT patent, 3 European patents, and over 60 Chinese invention patents. Her distinguished contributions have been recognized with awards including the Innovation Talent Award from the Chinese Overseas Community and the 2022 Hubei Provincial Second Prize for Scientific and Technological Progress. The scanning probe technology developed by her team was featured as a research highlight in Nature Methods.

Title: Deep Learning Based Inverse Design for Non-Parameterized MEMS Structural Design

Abstract: In light of the growing demand for miniaturized, high-performance sensors in the Internet of Things, the optimal design of Micro-Electro-Mechanical System resonators has become a critical challenge. Conventional design methods heavily rely on finite element analysis and engineers' prior knowledge, resulting in prolonged design cycles, high computational costs, and difficulties in achieving co-optimization of multi-objective performances. This presentation introduces a revolutionary design paradigm developed to address these challenges—an inverse design framework for MEMS resonators based on deep learning and genetic algorithms. This framework can automatically generate high-performance 3D structures directly from target physical properties like frequency, quality factor, and motional impedance, without predefining the model topology. Beyond enabling rapid (within 10 minutes) and accurate (average deviation < 3%) device design, this method also demonstrates exceptional versatility, supporting multiple vibration modes and a broad frequency range. Our research validates the algorithm's effectiveness via simulations and experiments, laying a solid foundation for its application in accelerating the innovative design of various MEMS devices.

Invited Speaker

14:30-14:50

Guoqiang Wu

Wuhan University

Bio: Guoqiang Wu is currently a Professor at Wuhan University. He received the B.Eng. degree in electrical science and technology from Xidian University, Xi'an, China, in 2008, and the Ph.D. degree in microelectronics and solid-state electronics from Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences, Shanghai, China, in 2013. From 2014 to 2018, he was a Research Scientist with the Institute of Microelectronics, Agency for Science, Technology and Research (A*STAR), Singapore. He is currently a Professor with the School of Integrated Circuits, Wuhan University, Wuhan, China. His research interests include MEMS resonators and oscillators, resonant micro/nanoelectromechanical system (M/NEMS) devices, and M/NEMS design and integration.

Dr. Wu has published more than 80 peer-reviewed papers (JMEMS, EDL, TED, TIE, APL, etc.) and contributed several conference talks (IEEE MEMS, IEEE NEMS, etc.), and authorized more than 40 invention patents. He has served as a member for the Technical Program Committee of IEEE MEMS Conference (2023 – 2024). He was a recipient of the Best Dissertation Award of Shanghai in 2014. Together with his students, he was the Finalist in Best Student Paper Competitions at IEEE MEMS (2021).

Title: Q and TCF Tuning for MEMS Resonators Through Mechanical Coupling

Abstract: MEMS resonators commonly suffer from limited quality factor (Q) and restricted freedom in tuning their temperature coefficient of frequency (TCF). This talk introduces a mechanically coupled resonator architecture in which resonant elements with intentionally differentiated dissipation and frequency-temperature characteristics are coupled to enable unified tuning of Q and TCF. When properly designed, the coupled elements are forced to oscillate synchronously at the same resonant frequency, such that the overall Q and TCF of the system are governed by the relative mass, stiffness, and mode participation of each component. As a result, passive Q enhancement and deterministic TCF tuning can be achieved through coupling geometry design, enabling MEMS resonators optimized for either temperature-compensated MEMS oscillators (TCMOs) or oven-controlled MEMS oscillators (OCMOs) implementations. The results highlight mechanical-coupling tuning mechanism as a practical design strategy for advancing high-performance MEMS resonators in timing and sensing applications.

Invited Speaker

14:50-15:10

Bo Xu

University of Electronic Science and Technology of China

Bio: Bo Xu, Associate Research Professor., received the Ph.D. in electrical science and technology from the University of Electronic Science and Technology of China. His research interests have focused on the design and application research of MEMS/NEMS devices based on two-dimensional materials. He has received two best paper awards at international conferences. As the corresponding author or co-author, he has published 19 papers in the following journals such as ACS Nano, Nano Lett., Small., Appl. Phys. Rev. Adv. Sci., Microsyst. Nanoeng.,and international conferences such as IEEE MEMS and IEEE NEMS.

Title: Modal Design of Anisotropic Nanomechanical Resonator

Abstract: In this report, we first establishes a device model based on a two-dimensional (2D) nanoelectromechanical resonator, and analyze the effects from the device configuration, geometric parameters and mechanics of materials. We then elaborates on the advantages and mechanisms of mechanical anisotropic materials in device modal design and control, and describes the evolutionary laws of device vibration morphology with changes in Young's modulus. Following that, the report will briefly introduce the spectroscopic microscopy imaging technology which is highly significant in anisotropic nanomechanical resonator modal research, conduct research on a rhenium disulfide resonator by utilizing this technology combined with device basic theories, extract the material's mechanical anisotropic parameters, and investigate the control effects of gate pressure modulation and internal stress on device modes

Invited Speaker

15:10-15:30

Xudong Zou

Aerospace Information Research Institute,Chinese Academy of Sciences

Bio: Xudong Zou received the B.Sc. degree in Microelectronics from Peking University, China, in 2009, and the Ph.D. degree in Microsystem from the University of Cambridge, U.K., in 2013. He was affiliated with the Nanoscience Center, Department of Engineering, University of Cambridge, as a Research Associate, and the Churchill College as a Post-Doctoral By-Fellow. He joined Institute of Electronics, Chinese Academy of Sciences in 2016 and is currently a Principal Investigator in Aerospace Information Research Institute, Chinese Academy of Sciences and a Professor in the School of Electronic, Electrical and Communication, University of Chinese Academy of Sciences. He is also the Founding Dean of the School of Electronics and Integrated Circuit, Aerospace Information Technology University. His main research interest lies in the area of MEMS, with a focus on Micro/Nano resonators in inertial sensor, magnetic sensor and signal process applications.

He also works on the sensor fusion technologies for autonomous navigation and distributed PNT applications. He has published over 90 peer-reviewed papers in the area of MEMS, Robotic and Artificial Intelligence and granted over 20 patents as co-inventor.

Title: Micro-Nano Resonators for Multi-Parameter Sensing

Abstract: In the last decades Micro/Nano resonators have emerged as excellent tools for sensing. Their applications cover a large range of fields going from the detection of extremely tiny forces to clinical diagnosis. As the size of the devices is scaling down to nanometre scale, researchers have improved considerably their sensibility. With the rapid advancement of the Internet of Things, precision medicine, and advanced manufacturing, there is a growing demand for the simultaneous, real-time monitoring of multiple physical parameters.Micro-nano resonators have become a research hotspot in the field of high-performance sensing due to their high-quality factor, excellent sensitivity, ultra-low power consumption, and ease of on-chip integration. However, traditional single-parameter sensing modes are susceptible to cross-sensitivity, making it challenging to achieve accurate multi-dimensional information decoupling in complex environments. This talk focuses on the latest advancements and core challenges of micro-nano resonators in multi-parameter sensing.

Technical Sessions

D2-PM-A06: Micro-Nano Chemical Sensor

13:30-15:30, April 18, 2026 **Meeting Room 305**

Session Chair: Cui Ye, Shanghai Jiao Tong University

Keynote Speaker

13:30-14:00 **Xing Sheng**

Tsinghua University

Bio: Xing Sheng is a professor in the Department of Electronic Engineering and the IDG/McGovern Institute for Brain Research at Tsinghua University, China. He received his bachelor degree from Tsinghua University in 2007 and PhD degree from Massachusetts Institute of Technology in 2012. He worked as a postdoctoral researcher at University of Illinois Urbana-Champaign from 2012 to 2015. His current interests are primarily in the exploration of implantable micro- and nano-scale optical and electronic devices for neural signal sensing and modulation. He has published papers in peer-reviewed journals like Nature Photonics, Nature Biomedical Engineering, Nature Communications, Science Advances, PNAS, etc. He is a senior member of IEEE, a life member of SPIE, and a fellow of Optica.

Title: Implantable Optoelectronic Devices for Advanced Neural Interfaces

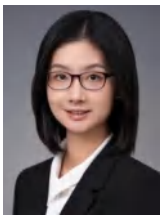
Abstract: Bio-integrated high performance inorganic optoelectronic devices will provide new insights on interactions between light and bio-systems. Here we present unconventional strategies to design and fabricate microscale, thin-film optoelectronics devices including micro-LEDs and photodetectors that can be formed via epitaxial liftoff and transfer printing techniques. These microscale devices can be heterogeneously integrated on flexible and stretchable substrates and interact with biological systems for biomedical applications. In particular, we produce multifunctional neural probes that can be directly implanted into the deep brain of freely moving animals, modulating and detecting neural activities in vivo. These photonic implants interrogate the nervous systems, providing insights for fundamental neuroscience studies and promises for medical applications.

Invited Speaker

14:00-14:20

Jiaqi Liu

City University of Hong Kong



Bio: Prof. Jiaqi Liu is a Presidential Assistant Professor in the Department of Mechanical Engineering at City University of Hong Kong. Before joining CityUHK in 2025, she was a postdoctoral scholar in the Querrey Simpson Institute for Bioelectronics at Northwestern University, working with Prof. John A. Rogers. She received her Ph.D. in Materials Science and Engineering from University of Pennsylvania under the supervision of Prof. Shu Yang in 2021. She obtained her B.S. in Materials Science from Fudan University in 2016. Her research focuses on leveraging functional soft materials, advanced manufacturing, ultrasound technology, and bioengineering approaches to advance multifunctional bio-integrated devices for measuring biological and biophysical signals, providing target modulation, and programming soft robotic actuators towards biomedical and healthcare applications. She has been selected as a Protostar by the weekly newsletter of Science magazine and has been awarded the Sidney J. Stein Prize and the Geoffrey Belton Graduate Fellowship by the University of Pennsylvania.

Title: Deep-tissue Chemical Sensing with Ultrasound

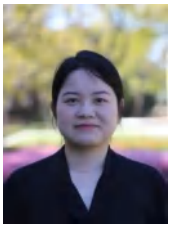
Abstract: Soft, bio-integrated devices exhibit the ability to collect physiological signals and offer therapeutic functions, posing a substantial impact on our understanding of biology and paving the way for precision medicine. With the assistance of advanced ultrasound technology, the innovative integration holds immense promise for sensing in deep tissues and complex anatomical structures that are otherwise difficult to approach. In this talk, I will highlight our recent advances in bioresorbable, ultrasound-readable sensors that enable real-time monitoring of chemically or physically specific parameters in deep tissues using ultrasound instruments. Specifically, this bio-integrated device incorporates symmetrically distributed metal discs embedded within a soft, pH-responsive hydrogel matrix, where the metal discs generate strong imaging contrast to allow ultrasound-based measurements of local pH variation. The envisioned clinical use is in early assessments of anastomotic leaks that can occur following gastrointestinal surgeries, where bioresorption after a recovery period bypasses the need for surgical extraction. I will conclude by discussing opportunities in leveraging bio-integrated devices and ultrasound to measure biosignals and especially biochemical signals to decipher biological systems and improve healthcare.

Invited Speaker

14:20-14:40

Cui Ye

Shanghai Jiao Tong University



Bio: Dr. Cui Ye completed her postdoctoral training at the California Institute of Technology (Caltech) in early 2025 and subsequently joined Shanghai Jiao Tong University as an independent Principal Investigator, doctoral supervisor, and discipline leader, where she leads the Flexible Sensing and Proactive Health research group. Her research centers on flexible electronic sensing technologies, with particular emphasis on wearable biosensors, noninvasive sweat monitoring, electrochemical analysis, microfluidics, and personalized digital health management. Dr. Ye has published over 50 peer-reviewed articles, receiving more than 4,150 citations with an h-index of 31. As a first or corresponding author, she has authored 22 publications in leading journals including Nature Nanotechnology, Nature Materials, and Chemical Society Reviews, with her work highlighted by Nature and other major scientific outlets.

She is a recipient of China's National High-Level Young Talent Program and the Shanghai Magnolia Young Talent Program. Dr. Ye has led three national and provincial research projects and holds four authorized Chinese patents and one international patent, which has been licensed and supported by external funding. She also received the MINE Distinguished Young Scientist Award. She currently serves as a Scientific Advisor to Perspective Health and as a Youth Editorial Board Member of The Innovation, Med-X, and Soft Science.

Title: Wearable Ultrasensitive Electronic Sensing for Proactive Health Management

Abstract: With the deepening of national digital transformation and the "Healthy China" initiative, non-invasive wearable sensing technologies are emerging as a research frontier in the field of health management. Ultra-sensitive wearable sweat analysis platforms that integrate flexible electronics, microfluidics, and electrochemical analysis enable real-time and continuous monitoring of physiological and metabolic signals, offering new opportunities for early disease screening, personalized diagnosis, and proactive health management. Sweat, as a biofluid rich in diverse biomarkers, reflects key physiological parameters such as metabolic status and hormone levels. Its non-invasive and continuously accessible nature makes it especially valuable for the digital and intelligent management of women's health. For instance, fluctuations in female hormone levels are closely associated with fertility, menstrual disorders, and menopause, and are critical for monitoring, intervention, and therapeutic evaluation in conditions such as infertility, polycystic ovary syndrome (PCOS), and menopausal transition. This report focuses on the precise detection of ultra-low concentration biomarkers in sweat, introducing the development of high-performance sweat sensing platforms from the perspectives of molecular recognition mechanisms, microfluidic chip design, and wearable system integration. It systematically reviews recent advances in sensor sensitivity, selectivity, and stability, and highlights strategies to address challenges such as signal interference, miniaturization, and long-term wearability. Furthermore, it explores the promising applications of these platforms in the digital and intelligent management of women's health, particularly

in scenarios requiring continuous, real-time hormone monitoring for reproductive health tracking, menstrual cycle analysis, early diagnosis of endocrine disorders, and personalized intervention.

Invited Speaker

14:40-15:00

Dengfeng Li

Shanghai Jiao Tong University

Bio: Li Dengfeng is an Associate Professor and a National-level Youth Talent at the Institute of Robotics, School of Mechanical Engineering, Shanghai Jiao Tong University. His research primarily focuses on robotic haptic feedback technologies, soft robotics, and wearable flexible electronics. He received his B.E. from Xi'an Jiaotong University, M.E. from Tsinghua University, and Ph.D. from City University of Hong Kong. He subsequently conducted postdoctoral research at City University of Hong Kong and Tampere University in Finland. His research outcomes have been published in prestigious journals such as Science Advances and Nature Communications as first author or corresponding author (including co-corresponding). He holds five granted invention patents from China and the United States and has received multiple awards, including the Gold Medal at the Geneva International Exhibition of Inventions, the Gold Medal at the Shanghai International Invention Exhibition, and the Second Prize of the China Invention Innovation and Entrepreneurship Award.

Title: Wireless Actuation and Sensing Technologies for Soft Robotics

Abstract: Soft robots, owing to their exceptional compliance and tissue-friendly properties, are indispensable for applications in extreme environments such as inside the human body or confined spaces. A central technical challenge in this field is achieving fully wireless actuation and sensing for soft robots operating within enclosed environments. This presentation will introduce how flexible electronics technologies such as radio frequency power delivery and near field communication（NFC）based sensing can be leveraged to realize wireless design and development of soft robots. For pipeline inspection in confined settings, we developed a highly integrated soft robot capable of wirelessly and passively monitoring multiple parameters including temperature, chemical ions and SARS-CoV-2 biomarkers. For biomedical applications, we engineered a miniaturized soft robot for deployment in the gastrointestinal tract. This device achieved prolonged adhesion within a pig's stomach and enabled tunable wireless precise electrical stimulation for in vivo regulation of ghrelin, the hunger hormone, demonstrating successful hormonal modulation inside a living pig.

Invited Speaker

15:00-15:20

Chaoyi Yan

University of Electronic Science and Technology of China

Bio: Dr. Chaoyi Yan is an Associate Researcher at the University of Electronic Science and Technology of China (UESTC). She serves as the Director of the Editorial Office for InfoMat and InfoScience. Dr. Yan received her Ph.D. in Materials Science and Engineering from UESTC in 2019. Her research focuses on the controllable synthesis of low-dimensional functional thin films and novel device design. To date, she has published 19 papers as the first or corresponding author in leading SCI-indexed journals, including Advanced Functional Materials, Advanced Energy Materials. In addition, she has secured multiple competitive grants, including a Young Scientists Fund from the National Natural Science Foundation of China (NSFC), three provincial/ministerial-level projects, and five national-level initiatives.

Title: Info+：Information is Everything in Everywhere

Abstract: Electronic information technologies and materials are of strategic importance to both national security and public welfare. Building on the strengths of its A+ discipline in Electronic Science and Technology and the first-class discipline in Integrated Circuit Science and Engineering, the University of Electronic Science and Technology of China (UESTC) collaborated with Wiley to launch InfoMat and InfoScience. Underpinned by the “Info” theme, two journals are dedicated to cutting-edge interdisciplinary research spanning electronics, materials, physics, chemistry, and artificial intelligence.

Technical Sessions

D2-PM-A07: Piezoelectric and Acoustic MEMS

13:30-15:25, April 18, 2026 **Meeting Room 306**

Session Chair: Yipeng Lu, Peking University

Keynote Speaker

13:30-14:00 **Huikai Xie**

Beijing Institute of Technology

Bio: Huikai Xie, Ph.D., Professor, School of Integrated Circuits and Electronics, Beijing Institute of Technology (BIT); Director of BIT Chongqing Institute of Microelectronics and Microsystems. He received his BS, MS, and Ph.D. degrees from BIT, Tufts University, and Carnegie Mellon University, respectively. He was an assistant researcher/a lecturer at the Institute of Microelectronics, Tsinghua University from 1992 to 1996. He joined the University of Florida as an assistant professor in 2002, and was promoted to the rank of Associate Professor with tenure in 2007 and Full Professor in 2011. He returned to his alma mater - BIT in 2020. He has published over 400 technical papers, holds 30+ US patents and 70+ Chinese invention patents. His current research interests include MEMS/NEMS, CMOS MEMS, optical MEMS, piezoelectric MEMS, inertial MEMS, LiDAR, NIR spectroscopy, and biophotonics. He is an associate editor of IEEE Sensors Letters, Sensors and Actuators: A, and Chinese Journal of Sensors and Actuators. He is a fellow of IEEE and SPIE.

Title: PZT-based Piezoelectric Micromachined Actuators

Abstract: Piezoelectric transducers have drawn extensive attention in the recent few years. PZT materials, either in ceramic, amorphous, or crystalline forms, all possess high piezoelectric coefficients, playing a crucial role in advancing microactuator technology for various applications. In this talk, we will explore how different PZT materials, including sol-gel, ceramic, sputtered and single-crystal PZT are applied in acoustic transducers and optical beam steering devices.

Keynote Speaker

14:00-14:30 **Zhenyu Wu**

State Key Laboratory of Transducer Technology, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences

Bio: Zhenyu Wu received his B.S. degree in Physics from Shandong University (SDU), Jinan, China, in 2004. He received M.Sc. and
Ph.D. degree both from Ulm University, Ulm, Germany, in 2006 and 2011, respectively. He

worked as R&D engineer and project
manager for MEMS technology at the Automotive Electronics Di#vision, Robert Bosch GmbH, Reutlingen, Germany, from 2011 to
2018. He joined the Shanghai Institute of Microsystem and In#formation Technology (SIMIT), Chinese Academy of Sciences (CAS) since 2018 as a professor, where he is currently director of the Laboratory of Transducer Technology. He is vice director at Shanghai Industrial μ Technology Research Institute (SITRI) and joint Professor at Shanghai University. He has published more than 50 papers, 30 international patents, and co-authored 4 books. His research interest includes advanced micro/nano fabrication technology, MEMS micro#systems and new sensors based on quantum effects

Title: A Novel Manufacturing Technology for Piezoelectric Mems Mpw Integrating Bimorph Alscn Process and Achievements

Abstract: This paper reports a novel piezoelectric MEMS multi-product wafer (MPW) manufacturing technique that integrates bimorph AlScN processing for the first time. It achieves a significant increase in actuation force without changing the materials used in the piezoelectric MEMS chips. By characterizing the resonant frequency and maximum displacement of cantilevered process control monitor (PCM) fabricated in MPW, it is demonstrated that the bimorph AlScN process effectively enhances the actuation performance of cantilever beams. Furthermore, compared to unimorph structures, the resonant frequency exhibits no significant change. We validated these results across different devices using the MPW platform, demonstrating that the 1+1 μm bimorph AlScN structure and the 1.5 μm unimorph AlScN structure increased the deflection angles of the two quasi-static piezoelectric micromirrors by 29% and 65%, respectively. For sensors, this bimorph structure does not enhance performance because the charges generated by the upper and lower piezoelectric films on the intermediate electrode cancel each other out.

Invited Speaker

14:30-14:50

Qingqing Ke

Sun Yat-sen University

Bio: Qingqing Ke received the bachelor’s and master’s degrees in materials science and engineering from Northwestern Polytechnical University, Xi’an, China, in 2005 and 2008, respectively, and the Ph.D. degree in materials science and engineering from the National University of Singapore, Singapore, in 2012. She was a Research Scientist with the Institute of Materials Research and Engineering (IMRE), A* STAR, Singapore. She is currently a professor with the School of Microelectronics Science and Technology, Sun Yat-Sen University, Zhuhai, China. Her research interests include piezoelectric film growth and acoustic device fabrication.

Title: Decoupling of Temperature-Strain Signals in Surface Acoustic Wave Sensors Using Machine Learning Algorithms

Abstract: Surface acoustic wave (SAW) sensors exhibit temperature-strain cross-sensitivity, which poses significant challenges for precise temperature and strain detection in complex environments. However,

currently reported decoupling methods generally increase assembling complexity of SAW sensors, therefore failing to achieve ideal decoupling performance. In this work, we proposed a scheme of decoupling the temperature-strain signal of the SAW sensor using a machine learning model, which was verified by the measurement from our developed SAW sensors. Using temperature and strain as output variables, we extracted key features from the frequency response signals of the three acoustic wave modes and constructed six machine learning models for prediction. Results show that the polynomial regression (PR) model achieved optimal overall performance across all three modes. This work provides a highly e cient and easily implementable solution for temperature-strain signal decoupling of the SAW sensors.

Invited Speaker

14:50-15:10

Weipeng Xuan

Hangzhou Dianzi University

Bio: Weipeng Xuan is a Professor and Ph.D. Supervisor at the School of Electronics and Information, Hangzhou Dianzi University. His research focuses on piezoelectric acoustic devices and piezoelectric MEMS systems, including SAW/BAW RF devices, piezoelectric MEMS micro-pumps, and piezoelectric acoustic integrated circuits for applications in wireless communication and microfluidic systems.

Title: Piezoelectric MEMS Micro-Pumps and Their Applications in Medicine and Chip Cooling

Abstract: Piezoelectric MEMS micro-pumps have emerged as a key enabling technology for precise micro-scale fluid actuation, offering solid-state operation, compact form factors, low power consumption, and high reliability. By utilizing the electromechanical coupling of piezoelectric thin films to drive diaphragm deformation, these pumps achieve controllable volumetric displacement without rotating components, making them uniquely suited for both biomedical systems and advanced electronic thermal management. In this talk, we will repport our progress of micropump and their use medical and thermal cooling applications

Technical Sessions

D2-PM-A08: Micro/Nanomechanical Inertial Sensors

13:30-15:30, April 18, 2026 **Meeting Room 307**

Session Chair: Hemin Zhang, Northwestern Polytechnical University

Keynote Speaker

13:30-14:00

Yongjun Huang

University of Electronic Science and Technology of China

Bio: Yongjun Huang received the M.S. and PhD. degrees from University of Electronic Science and Technology of China (UESTC), Chengdu, China, in June 2010, and December 2016. From September 2013 to September 2015, he was a visiting scholar with the Solid-State Science and Engineering, and Mechanical Engineering, Columbia University, New York City, NY, USA, and a visiting project scientist with the Electrical Engineering, University of California at Los Angeles (UCLA), Los Angeles, CA, USA. He is currently the Professor with School of Information and Communication Engineering, UESTC. His research interest involves novel high-precision micro-inertial sensor chip technology based on cavity optomechanics and its application in inertial/integrated navigation systems. He has published over 130 high-quality papers in journals such as Nature Communications, Science Advances, eLight, Light: Science & Applications, Laser & Photonics Reviews, and Research, with more than 60 papers as the first author or corresponding author. The papers have been cited over 4,400 times on Google Scholar, with an H-index of 34. They hold more than 30 authorized invention patents and have delivered over 10 invited talks at international academic conferences.

Title: High-Precision Micro Inertial Sensors Based on the 2D PhC Optomechanic Cavity

Abstract: Cavity optomechanics is a kind of structure that can exhibit both optical resonances and mechanical oscillations, and such phenomena can interact strongly to each other. It is an emerging platform for fundamental physics and engineering application investigations. Recent years, several kinds of micro/nano structures can be used to realize cavity optomechanics. Among of those cavity optomechanical structures, the 1D/2D nano photonic crystal (PhC) beam/slab can be widely used to achieve highly-integrated sensors, because of that it can be co-fabricated with conventional MEMS and CMOS procedures. In this talk, we would like to summarize our recently research achievements on the demonstrations of cavity optomechanical micro inertial sensors based on the planar 2D PhC slabs, including the single-axis accelerometers and gyroscopes. We will introduce the operating principles, design guides, fabrication procedures, and measurements results for the proposed accelerometer and gyroscope. And in the end, we will also discuss the challenges for achieving the really integrated cavity optomechanical inertial sensors, for examples, the integrated laser sources, polarization controllers, high-efficient waveguides and couplers, and the photodetectors and vacuum packages.

Keynote Speaker

14:00-14:30

Jun Tang

North University of China

Bio: Jun Tang is a professor and doctoral supervisor at North University of China. Currently, he is a national-level scientific and technological leading talent, a national outstanding young researcher, and the chief scientist of the XX3 program. He serves as the dean of School of Semiconductor and Physics of North University of China and the deputy director of the National Key Laboratory of "Wide Bandgap Semiconductors Beyond Lighting Materials and Technology". He has been responsible for more than 20 national and provincial-level projects, including key projects of the National Natural Science Foundation of China and instrument-specific projects.

Prof. Tang has formulated 3 national standards, obtained more than 50 national invention patents, and published over 170 SCI papers. He has successively won the First Prize of Technical Invention of the Instrumentation Society, the First and Second Prizes of Technology Invention of Shanxi Province, and the Special Prize of Teaching Achievement of Shanxi Province. He has also received various honors such as the Young Talents Award of the Communist Party of China Shanxi Provincial Committee, the Outstanding Expert Award for Science and Technology Innovation of Shanxi Province, and the Academic and Technical Leader Award of the Shanxi Provincial Human Resources and Social Security Department.

Title: Resonant Micro Optical Electromechanical Sensing Technology

Abstract: High-precision and miniaturized mechanical sensor devices have significant demands in areas such as unmanned platform navigation, satellite attitude adjustment and orbit change, and precision processing. This report focuses on the cavity optomechanical enhancement effect, concentrating on the interaction mechanism between photons and phonons in confined spaces, and systematically investigates the application of resonant MOEMS sensing. Leveraging breakthroughs in the precision fabrication of high-quality optical microcavities, it achieves stable and efficient coupling conversion between optical fields and phonon modes. This technology is applied to various high-precision sensing fields, resulting in the development of a series of high-performance sensor devices, including gyroscopes, accelerometers, acoustic sensors, magnetic sensors, and mass sensors. This work demonstrates the potential and practical application prospects of resonant MOEMS in multiphysics sensing.

Invited Speaker

14:30-14:50

Yuan Wang

University of Macau

Bio: Yuan Wang received his B.Eng. degree in Electronic Engineering from the University of Birmingham, Birmingham, U.K., in 2011; his M.Sc. degree in Bioelectronics from the University of Edinburgh, Edinburgh, U.K., in 2012, and his Ph.D. degree in microelectromechanical systems (MEMS) from the University of Liege in 2019. From 2020 to 2023, he worked as a research associate at Huazhong University of Science and Technology, PGMF and School of Physics, MOE Key Laboratory of Fundamental Physical Quantities Measurement & Hubei Key Laboratory of Gravitation and Quantum Physics, China. He is currently working as an assistant professor at the University of Macau, Institute of Microelectronics. He has published over 90 papers in the MEMS-relevant journals/conferences. His research interests include MEMS sensors, micro-resonators, nonlinearity of MEMS devices, and MEMS interfaces.

Title: Single Micro-Resonator Sensory Fusion for Inertial Sensing Applications

Abstract: Micro Electro Mechanical Systems (MEMS) technology undeniably stands out as a pivotal advancement in the realm of modern electronic science. MEMS products have permeated various aspects of daily life, catering to diverse industries and offering solutions characterized by miniaturization, high performance, and low power consumption. In light of the evolving trend towards intelligent sensor technology, MEMS devices must not only enhance their performance but also incorporate multi-parameter sensing capabilities to align with the requirements of sensor fusion, Internet of Things, and smart city initiatives. This report will commence by exploring the application of MEMS resonant sensors, delving into a detailed analysis of various sensitization schemes based on parameter modulation mechanisms, particularly for inertial sensing applications. Additionally, it will encapsulate the recent research endeavors undertaken by the research group in this domain.

Invited Speaker

14:50-15:10

Cun Li

Xi'an Jiaotong University

Bio: Li Cun, Professor at Xi’ an Jiaotong University, Awardee of National Youth Talent Program. His research focuses on MEMS quartz resonant and silicon piezoresistive technologies, specializing in precision pressure/acceleration sensing for aerospace and petrochemical applications. In the field of MEMS sensors, he has led over 20 research projects emphasizing the design, fabrication, and control circuits for high-precision pressure/acceleration sensors. As the first or corresponding author, he has published 25 SCI-indexed papers and holds 18 authorized or pending invention patents. He has received the First Prize of the Ministry of Education for Technological Invention in 2025 (ranking 2nd) and the First Prize of the China Association of Inventions in 2024 (ranking 2nd).

Title: The Development of Quartz Resonant Sensors

Abstract: High-precision acceleration sensors measure the acceleration, velocity, and position of moving carriers, serving as the information source for autonomous inertial measurement and positioning. Quartz resonant accelerometers utilize the inherent piezoelectric properties and long-term stability of quartz to enable direct frequency-based digital measurement of acceleration signals.

This report addresses the demand for high-precision accelerometers in inertial navigation systems for UAVs and precision-guided equipment. It outlines the opportunities and application challenges faced by quartz resonant acceleration sensors, and presents the latest research advances from our team in quartz resonant sensor development, including vibration control methods for quartz resonators, quartz microfabrication processes, sensing structure design, and coupling interference in differential structures.

Invited Speaker

15:10-15:30

Huiliang Cao

Beijing Institute of Technology

Bio: Professor at Beijing Institute of Technology, PhD supervisor. Selected as a national high-level young talent, executive vice president of Chongqing Microelectronics Research Institute of Beijing Institute of Technology, special young scholar of Beijing Institute of Technology, national second-level entrepreneurial consultant, IEEE Senior Member, selected as one of the top 2% of the world's top scientists. Conducts research work around intelligent sensing chip related technologies, including MEMS sensing chips, bionic MEMS chips, intelligent integrated microsystems, complex environment testing technology, etc. Presides over more than ten national/provincial/ministerial projects such as national key research and development plans (projects), national natural science funds, etc., has published 4 monographs/textbooks, over 150 SCI papers, and has been granted 46 national invention patents. Serves as an editorial board member of the "Navigation and Control" journal, a young editorial board member of the "Navigation, Positioning and Timing" and "Measurement and Testing Technology" journals, and the chief editor of a special issue of the "Micromachines" journal. Guides students to participate in various academic competitions and has won more than 40 national and provincial awards. Serves as a member of the Sensor Branch Committee of the China Instrumentation Society, a member of the Dynamic Testing Technology Professional Committee of the China Instrumentation Society, and a member of the Navigation, Guidance, and Control Professional Committee of the China Automatic Control Society. Has won the Geneva Invention Gold Award (R1), the First Prize of Technical Invention of the Instrumentation Society (R2), the First Prize of Natural Science Award of Shanxi Province (R3), the Second Prize of Invention and Entrepreneurship Achievements of the China Invention Society (R1), the Special Contribution Award of the China Association for Science and Technology (R1), and a second-class provincial teaching achievement award, among other scientific awards.

Title: Intelligent Monolithic Three-Axis MEMS Gyroscope Chip

Abstract: This report proposes a novel structure of monolithically integrated three-axis MEMS gyroscope based on a ring topology, which adopts a single-drive and three-detection working mechanism to achieve synchronous sensing and decoupling of three-axis angular velocities on a single chip. The modal analysis and optimization of the structure are carried out through finite element simulation, and the modal matching design is completed. In response to the inter-axis coupling problem that is prone to occur in monolithically integrated structures, a systematic analysis is conducted at the mechanism level, and a suppression strategy combining structural decoupling and electrical compensation is proposed. To rationally configure the drive and detection electrodes for each vibration mode, their electrostatic excitation efficiency and capacitive detection sensitivity are evaluated separately, ensuring the effectiveness of signal generation and extraction. Finally, a prototype of the gyroscope is fabricated based on micro-machining technology, and its basic parameters are experimentally tested.

Technical Sessions

D2-PM-A09: Nanodevice Physics

13:30-15:30, April 18, 2026 **Meeting Room 308**

Session Chair: Zejuan Zhang, University of Electronic Science and Technology of China

Keynote Speaker

13:30-14:00

Jianhao Chen

Peking University

Bio: Dr. Jian-Hao Chen is currently a Professor at the School of Physics, Peking University. He received his PhD in Physics from the University of Maryland in 2009. After graduation, he worked as a post-doctoral researcher at the University of Maryland and the University of California, Berkeley. He joined ICQM, Peking University as a tenure-track Associate Professor in 2013, and then promoted to tenured Associate Professor in 2019, and to tenured Full Professor in 2024. His research interests focus on quantum transport and device physics of low-dimensional materials, including topological and correlated materials, magnetic materials and high mobility materials as well as their heterostructures. He has published more than 60 papers with more than 12,000 citations (Google Scholar). He has also been listed as the most cited Chinese Researchers for the year of four consecutive years from 2021 to 2024 by Elsevier. He is currently the Physics Editor of National Science Review and Associate Editor of npj 2d Materials and Applications.

Title: Spin Transport With Magnon-Flat Bands and Spin-Spin Correlations

Abstract: van der Waals magnets have been a fertile playground for low-dimensional spin excitation and spin-based device applications; spin-spin correlations in complex spin structures provide exotic correlated states that might facilitate spin excitation and transport. We will discuss our recent process in a long distance, quasi-1D magnon transport in a 2D spin lattice, aid by the formation of a flat magnon band; short introduction of an electrically operated digital magnon NOT gate[1] and an electrically operated magnon anisotropic read-only memory [2] will also be provided; lastly, we will discuss an ultra-long distance spin transport phenomena based on spin-spin correlation instead of conventional exchange interactions (Figure 1)[3]. These results unveil the potential of van der Waals anti-ferromagnets and complex magnetic materials for studying highly tunable spin physics and for application in magnon-base circuitry in future information technology.

Online publication: https://www.nature.com/articles/s41467-025-68203-4

Invited Speaker

14:00-14:30

Xiaoxi Li

Shanxi University

Bio: Xiaoxi Li is an associate professor at the Institute of Optoelectronics, Shanxi University. Her research
focuses on van derWaals layered functional materials, investigating their stacking and novel architectural
designs to develop prototype mesoscopic deviceswith advanced multifunctional regulation capabilities.
She also explores the physical mechanisms governing electric-field-controlled mesoscopic systems.

Title: Monolithically Sculpted van der Waals Nano-Opto-Electro-Mechanical Systems: From Deterministic Manufacturing to Multi-physical Coupling

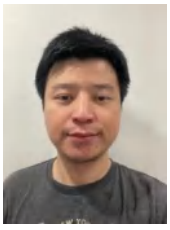
Abstract: Two-dimensional van der Waals (vdW) heterostructures are ideal platforms for nano-opto-electromechanical systems (NOEMS), yet their development is hindered by the fabrication challenges of suspended architectures. Here, we developed a universal "monolithically sculpted" dry-etching method to robustly fabricate suspended vdW heterostructure arrays. Based on this platform, we demonstrate a multifunctional NOEMS that seamlessly integrates a high-Q nanomechanical resonator, a vacuum-channel field-emission diode, and an ultrafast thermal light source. Furthermore, exploiting the extreme sensitivity of NOEMS, we optically detected a giant blueshift in the mechanical resonance induced by the antiferromagnetic phase transition of 2D CrOCl. Crucially, we recently pushed this platform into the topological regime, observing a strong coherent coupling between macroscopic mechanical vibrations and quantum Hall edge states under high magnetic fields. Our work provides a scalable approach for deterministic atomic-scale manufacturing and paves the way for next-generation on-chip quantum simulators with mechanical degrees of freedom.

Invited Speaker

14:30-14:50

Shengwei Jiang

Shanghai Jiao Tong University



Bio: Received B.S. and Ph.D. degrees from Nanjing University, and subsequently conducted postdoctoral research at Penn State University (PSU) and Cornell University in the United States. Joined the School of Physics and Astronomy at Shanghai Jiao Tong University in 2021 as a tenure-track associate professor and Ph.D. supervisor. Research focuses on condensed-matter optics, low-dimensional magnetism, and strong-correlation and topological physics in moiré superlattices of two-dimensional semiconductors. Expertise includes using a range of techniques — such as microwave spin resonance, micro-optical (spectroscopic) methods, and mechanical resonators — under low temperatures and high magnetic fields to probe magnetism and correlated electronic

states. In recent years, has carried out a series of studies in spintronics, two-dimensional magnetism, and strong-correlation magnetism and topological physics in semiconductor moiré superlattices.

Title: Correlated Topological Phases in Flat Chern bands of Moiré TMD

Abstract: Correlated topological phases emerging from the interplay between electron – electron interactions and band topology have become a central theme in moiré quantum materials. In moiré transition-metal dichalcogenides (TMDs), long-wavelength periodic potentials can produce isolated, ultra-narrow Chern bands with large Berry curvature and valley-contrasting topology, providing an ideal setting to realize interaction-driven topological matter. In this work, we investigate correlated phases in flat Chern bands of moiré TMD heterostructures. We identify regimes where strong correlations stabilize valley/spin polarized states and interaction-induced topological electronic crystal states without an external magnetic field.

Invited Speaker

14:50-15:10

Tao Jiang

Tongji University

Bio: Tao Jiang is a Professor at the School of Physics Science and Engineering, Tongji University. He received his B.S. in Physics from East China Normal University in 2010 and his Ph.D. in Condensed Matter Physics from Fudan University in 2015. From 2016 to 2019, he worked as a Postdoctoral Researcher in the Department of Physics at the University of Colorado Boulder. He joined Tongji University as a Professor in 2020, where he established a research group focusing on low-dimensional nonlinear photophysics and nanoscale optical microscopy. His research explores optical phenomena in low-dimensional materials and micro/nano-structures, and develops optoelectronic devices operating across the visible to mid-infrared spectrum at the micro- and nano-scale. He has authored or co-authored over 40 papers in peer-reviewed journals, including Nature Nanotechnology and Nature Photonics.
For more information, please visit: https://ipoe.tongji.edu.cn/MDOM_en.htm

Title: Dynamically engineered polaritons in α-MoO3/graphene heterostructures

Abstract: Anisotropic phonon polaritons, owing to their strong directionality and deep subwavelength confinement, have emerged as a central platform in infrared nanophotonics, with promising applications in photodetection, information processing, and energy conversion. Among various van der Waals materials, low-symmetry α-MoO3 exhibits intrinsic biaxial dispersion, offering a unique foundation for controlling polaritonic behaviors.

Building upon this, we constructed twisted bilayer α-MoO3 heterostructures and, for the first time, realized hyperbolic shear polaritons in a 2D system. By tuning the twist angle and the thickness of the top α-MoO3 layer, and further integrating monolayer graphene, we achieved multidimensional and highly

tunable control of polariton propagation [1]. Infrared near-field analysis reveals that the electrically tunable Fermi level of graphene enables real-time modulation of polariton wavevector, intensity, and loss rate. The results uncover a nontrivial dependence of the polariton momentum components on the Fermi level [2].

Furthermore, by introducing periodic nanostructures to form polaritonic crystals (PoCs) and coupling them with graphene, we electrically reconstructed Bloch bands and enhanced the polariton density of states, thus overcoming the intrinsic static nature of conventional PoCs [3]. Leveraging the flat isofrequency contours of the twisted structure, we designed the lattice periodicity and orientation to experimentally realize the directional excitation of low-loss Bloch modes [4].

We have experimentally demonstrated a multidimensional modulation strategy that combines twisted bilayer architectures, periodic nanostructures, and external field control. It provides new physical insights and a versatile platform for developing reconfigurable and programmable polaritonic nanophotonic devices.

Invited Speaker

15:10-15:30

Li Tao

Southeast University

Bio: Dr. Li Tao is a full professor in the School of Materials Science and Engineering at Southeast University, Nanjing, China. His research interests focus on 0-2D materials and their flexible/wearable devices and circuits for internet of things, energy, and health care. He is the inventor of 2D PtSe2 enabled self-powered wireless transceiver-sensor circuits for GHz flexible RF communications (IEDM 2024) and the first silicene transistor (Nat. Nanotechnol. 2015, over 1300 citations) featured by TIME blog, Nature News and 100+ media. Dr. Li Tao is an associate editor for npj 2D Materials & Applications, Research and Microelectronics Engineering. He has served as the general chair for NMDC 2020&2022 and a key organizer for 2D materials and nanoelectronics sessions in MRS 2024. His recent honors and awards include IEEE Nanotechnology Council Distinguished Lecturer (2023 &2024), Young Scientist Award by Chinese Renewable Energy Society (2024), Silver award by Geneva Invention Exhibition (2023) and etc.

Title: Switchable Ambipolar MoTe2 Transistors on Flexible Substrates

Abstract: Molybdenum ditelluride (MoTe2), a recently emerging two-dimensional transition metal dichalcogenide (TMDC), has demonstrated excellent electrical properties for next-generation flexible electronics. However, its devices still suffer from limited carrier mobility and ineffective modulation of ambipolar transport behavior. Herein, this work represents a flexible locally buried-gated MoTe2 transistors that feature hole and electron mobilities up to 50 $cm^2 V-1 \cdot s-1$, respectively. Both hole and electron mobilities exhibit monotonic decline with increasing strain, accelerating dramatically beyond a critical strain threshold (ε = 0.7%). The initial gradual increase in barrier height (28 meV/%) is attributed to lattice distortion in MoTe2, whereas the subsequent abrupt surge (325 meV/%) correlates to the interfacial delamination between Au electrodes and the semiconductor. The strain-dependent band

structure and tunnelling efficiency enable the ambipolar-to p-type transport transition. It can achieve effective modulation of flexible transistors in aspects like carrier injection, scattering and transport. Our work provides an alternative strategy to approach wearable CMOS technology.

Technical Sessions

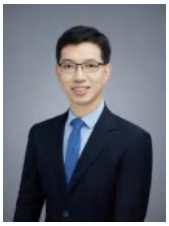
D2-PM-A10: Micro/Nanoelectronic Materials and Devices

13:30-15:30, April 18, 2026 **Convention Hall A**

Session Chair: Yu Zhou, Central South University

Keynote Speaker

13:30-14:00



Caofeng Pan

Beihang University

Bio: Professor Caofeng Pan is a distinguished Professor at Beihang University (BUAA), Doctoral Supervisor, and awardee of the National Science Fund for Distinguished Young Scholars. He earned his bachelor's (2005) and doctoral (2010) degrees from the School of Materials Science and Engineering, Tsinghua University. He received the National Excellent Doctoral Dissertation Award of China in 2012. He subsequently conducted postdoctoral research in the School of Materials Science and Engineering at the Georgia Institute of Technology, USA. From 2013 to 2023, he served as a Professor and group leader at the University of Chinese Academy of Sciences and the Beijing Institute of Nanoenergy and Nanosystems, CAS. His research focuses on atomic-level manufacturing and low-dimensional semiconductor materials/device for sensing applications. He has published over 320 SCI papers in leading journals such as Nature Photonics, Nature Communications, Advanced Materials, Chemical Reviews, and Advanced Energy Materials. His work has been cited more than 31,000 times (Google Scholar), with an H-index of 97. Over 30 of his papers have been recognized as "China’s 100 Most Influential International Academic Papers" or "ESI Highly Cited Papers". He holds 3 U.S. patents and over 40 Chinese patents. He currently serves as an Associate Editor of Science Bulletin and Nanotechnology. He is Vice Chair of the Cross-disciplinary Branch of the Chinese Materials Research Society, Executive Director of the Smart Sensing Functional Materials and Devices Branch, Director of the Nanomaterials and Devices Branch, and Vice Chair of the Alliance for Innovation and Development in Atomic-level Manufacturing.

Title: Metal Halide Perovskite Arrays and Artificial Vision Imaging Devices

Abstract: High-performance optoelectronic sensor arrays with human-like visual perception capabilities are essential for intelligent robotics and embodied sensory systems. This report focuses on the application of metal halide perovskite materials in artificial vision systems, and systematically reviews their advantages and challenges in constructing large-area, high-resolution, and low-cost image sensors. To address limitations in conventional devices—such as inadequate full-color recognition, poor conformability, and lack of neuromorphic processing — the research team developed scalable fabrication strategies for perovskite polycrystalline and single-crystal film arrays. These strategies leverage wettability patterning,

vapor-phase deposition, and spatial confinement methods to achieve high crystallinity, controllable size and position, and resolutions exceeding 400 PPI.

At the device level, flexible and ultrathin perovskite photodetector arrays were constructed, with thickness as low as 2.4 μm and weight of only 3.12 g/m², enabling conformal contact with curved surfaces. These arrays demonstrate real-time, low-aberration, and highly sensitive (up to 5.17×10^{12} Jones) curved-surface optical imaging. A 3D integrated structure incorporating Bayer filters and convolutional neural networks (CNNs) was developed to realize full-color image sensing with low chromatic aberration ($\Delta E = 0.45$), enabling precise color recognition, static image denoising, and dynamic trajectory tracking. Furthermore, neuromorphic image processors based on positive – negative photoconductivity were proposed, enabling in-sensor visual preprocessing for static and dynamic scenes.

This research achieves significant advances in perovskite array synthesis, heterostructure device design, and high-density integration, accelerating the development of neuromorphic vision systems and providing next-generation high-performance visual perception solutions for applications in robotics, autonomous driving, medical imaging, and surveillance.

Keynote Speaker

14:00-14:30

Guozhen Shen

Beijing Institute of Technology

Bio: Guozhen Shen received his PhD degree (2003) in chemistry from University of Science and technology of China. He then conducted research in several counties, including Korea, Japan, US and China. Currently, he is a professor at School of Circuits and Integrated Electronics and the director of the Institute of Flexible Electronics, Beijing Institute of Technology. His research focuses on flexible electronics and printable electronics and their applications in healthcare monitoring, smart robots and related areas.

Title: Flexible Eye-Wearable Electronic Materials and Devices

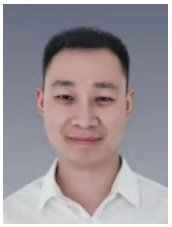
Abstract: Wearable soft contact lens sensors for continuous and nondestructive intraocular pressure (IOP) monitoring are highly desired as glaucoma and postoperative myopia patients grow, especially as the eyestrain crowd increases. 2D transition-metal carbides and/or nitrides, known as MXenes have been spotlighted in the field of wearable and portable devices owing to their fascinating properties including high electronic conductivity, superior transparency, excellent mechanical flexibility, hydrophilicity and biocompatibility, etc. Such diverse advantages make feasibility and applicability of using Ti3C2Tx MXene in wearable contact lens sensors, thus achieving the IOP monitoring. In this talk, we will introduce our recent work related to MXenes for eye-wearable electronic applications.

Invited Speaker

14:30-14:50

Shenghai Pei

University of Electronic Science and Technology of China



Bio: I earned my Ph.D. in Physics from Harbin Institute of Technology in January 2021. Following graduation, I conducted postdoctoral research at the Institute of Fundamental and Frontier Sciences (IFFS), University of Electronic Science and Technology of China (UESTC). In 2024, I joined IFFS as a Specially-appointed Associate Researcher.

My research focuses on low-temperature and high-pressure spectroscopy of two-dimensional semiconductor materials. I have published over 30 papers in prestigious international journals, including Reports on Progress in Physics, ACS Nano, Applied Physics Reviews, Materials & Design, Physical Review B, and Applied Physics Letters. I have led and participated in multiple projects funded by the National Natural Science Foundation of China, Sichuan Provincial Natural Science Foundation, and China Postdoctoral Science Foundation General Program. I was honored with the "Outstanding Postdoctoral Researcher" award by both UESTC and the IFFS.

Title: Tuning and Quantifying Electron-Phonon Coupling in 2D Cr-Based Systems

Abstract: Electron-phonon coupling （EPC）plays a crucial role in various physical phenomena, and modulating its strength is particularly important for exploring and designing high-performance materials. However, current research lacks precise methods for controlling and quantifying EPC, hindering further understanding of underlying physical processes. In this work, we investigate the quantitative tuning of EPC in CrBr3 via pressure combined with in situ spectroscopic techniques. We successfully identify unambiguous signatures of EPC—pronounced vibrational modes and strong Stokes shifts—which enable us to precisely quantify the Huang-Rhys factor S at actual sample temperatures, thereby accurately determining the EPC strength. Furthermore, we reveal that pressure can effectively modulate the EPC strength. This work provides a novel approach for tuning and quantifying EPC, offering both theoretical and technical support for exploring and designing functional materials with targeted EPC strengths.

Invited Speaker

14:50-15:10

Ting Wen

Huzhou College

Bio: Ting Wen is currently a Lecturer at Huzhou College. She received her Ph.D. degree in Electronic Science and Technology from the University of Electronic Science and Technology of China in 2023. Her research interests focus on optical spectroscopy of two-dimensional (2D) semiconductors, in-situ tuning of their optical properties (e.g., via pressure), optical anisotropy in 2D materials, and polarization-dependent optical characterization and analysis. She has published more than 10 SCI-indexed papers in this field and has been supported by one project from the Zhejiang Provincial Natural Science Foundation and one municipal-level research grant.

Title: Calibrating van der Waals Force via Layer Engineering

Abstract: van der Waals (vdW) interaction, a fundamental force, plays an important role in two-dimensional (2D) systems by enabling atomically-sharp assemblies and giving rise to many emergent phenomena. However, direct calibration of vdW interaction between 2D layers remains challenging due to its extreme weakness, very short range, and the difficulty of keeping two atomic layers perfectly parallel while finely adjusting their spacing. Here we demonstrate an alternative strategy to calibrate vdW force via layer engineering. We directly construct heterostructures using isotropic MoS2 and anisotropic NbIrTe4 to ensure perfect parallelism. We modulate and quantify the vdW interaction by varying NbIrTe4 thickness and monitor the vdW-interaction-induced anisotropy in MoS2. We find the vdW force to strongly depend on NbIrTe4 thickness, clearly observe its fast-decaying nature, and reveal that material-dependent screening effect plays a non-negligible role in vdW interaction. Our results provide a practical alternative for calibrating and understanding vdW force between atomic layers.

Invited Speaker

15:10-15:30

Yongzheng Wen

Tsinghua University

Bio: Yongzheng Wen is an Associate Researcher at the School of Materials Science and Engineering, Tsinghua University, and serves as Deputy Director of the State Key Laboratory of New Ceramic Materials. His research primarily focuses on metamaterials, with particular emphasis on exploring fundamental physical mechanisms, realizing extraordinary electromagnetic/terahertz properties, and developing their applications. He has published over 40 papers in international journals and conferences including Physical Review Letters, National Science Review, Materials Today, and Research. As principal investigator, he has led multiple national-level projects such as the National Key R&D Program project and NSFC grants. He has been recognized as a National-level Youth Talent Program and selected for the China Association for Science and Technology (CAST) "Young Talent Support Project." Currently, he holds the position of Deputy Secretary-General of the Metamaterials Branch at the Chinese Materials Research Society (CMRS).

Title: Artificial Optical Nonlinearity Generated by Metamaterial and Terahertz Applications

Abstract: Nonlinear optics is one of the core fields in modern optics, but constrained by the unclear physical processes in natural nonlinear materials, the on-demand artificial design of optical nonlinearity has been largely unattainable, significantly impeding further development in related technological domains. This report presents an artificial optical nonlinearity realized through metamaterial structural coupling, along with its application examples in terahertz harmonic generation and photodetection. Unlike natural nonlinearity, this artificial approach requires no participation of specialized natural nonlinear materials while enabling various nonlinear effects including second-harmonic generation and optoelectronic conversion. Moreover, by modifying the metamaterial structures, the nonlinear characteristics can be artificially designed and controlled with ultrahigh degrees of freedom. Furthermore,

addressing the "terahertz gap" issue inherent to natural nonlinear materials, we have explored artificial optical nonlinearity to successfully generate terahertz second-harmonic and third-harmonic signals at room temperature with exceptionally high equivalent nonlinear coefficients. These research findings are expected to open new possibilities for research and applications in nonlinear optics, terahertz technology, and metamaterial fields.

Technical Sessions

D2-PM-A11: Emerging Micro/Nano Technologies

13:30-15:20, April 18, 2026 **Convention Hall F**

Session Chair: Xudong Zou, AIRCAS

Keynote Speaker

13:30-14:00 **Frank Sun**

Nature Sensors

Bio: Frank joined Nature Sensors in 2025. He earned his Ph.D. in Molecular Engineering from the University of Chicago, where his research focused on the design and development of bioelectronic materials and systems. At the journal, he handles manuscripts across bioelectronic and biomedical sensing platforms. He is based in Jersey City, USA.

Title: Nature Sensors: Connecting the Global Sensing Community

Abstract: Nature Sensors is a monthly online journal launched in January 2026, dedicated to publishing pioneering research across the full spectrum of sensing technologies. The journal brings together contributions from leading scientists, engineers, and industry experts, with a focus on interdisciplinary, application-driven innovation spanning life sciences, artificial intelligence, robotics, electronics, sustainability, and beyond. In this talk, I will introduce the scope of the journal, outline the types of research we aim to publish, and discuss our editorial standards and submission workflow. I will also highlight the different content types we offer, share ongoing projects at the journal, and address questions about publishing with the journal.

Keynote Speaker

14:00-14:30 **Fan Dong**

University of Electronic Science and Technology of China

Bio: Dr. Fan Dong is a full professor at the Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China (UESTC). He serves as the director of the Research Center for Carbon-Neutral Environmental & Energy Technology at UESTC, and also the Associate Editor of ACS ES&T Engineering. He earned his PhD from Zhejiang University in 2010. He has published more than 200 papers on renown journals such as JACS, PNAS, Chem, Nature Communications, Angewandte Chemie, Energy & Environmental Science, Environmental Science & Technology, Research, ACS Nano, ACS Catalysis, ACS Sensors, Science Bulletin, Advanced Energy Materials and so on. He has an H-index of 125 and the total citation of his publication reaches more than 57000 times. In

recognition of his contributions, he was awarded the National Natural Science Funds for Distinguished Youth Scientist of China in 2022 and has been consistently recognized as a highly cited researcher by Clarivate Analytics from 2018 to 2023. His research interests span environmental and energy catalysis, advanced in situ characterization technology, and gas sensors.

Title: Orbital-Level Chemical Coding for Exclusive Detection of VOCs Gases in Chemiresistive Sensors

Abstract: Cost-effective chemiresistive gas sensors are widely applicated in the commercial detection of volatile organic compounds (VOCs). However, their poor selectivity towards a target VOC within chemically similar mixtures impedes both qualitative and quantitative accuracy. This arises from the absence of intrinsic chemical criteria for designing selective sensing systems. This research emphasizes the importance of orbital engineering to achieve selectivity in chemiresistive materials. We tailor O 2p-band center (ε O- 2p) of the model material SnO2, achieving near 100% selectivity towards triethylamine (C6H15N) and exceptional selectivity towards formaldehyde (CH2O), respectively, and maintaining these selectivity performances in gas mixtures. Specifically, tailoring the ε O- 2p enables energy-level matching between O 2p orbitals and frontier molecular orbitals (FMOs) of distinct VOCs gases, thereby inducing selective orbital hybridizations. Such hybridization drives specific adsorption-reaction processes and provides the electron-transfer channel, ultimately triggering the exclusive electrical response. These findings not only unveil the origin of sensing selectivity but also establish a chemical coding strategy for the rational design of exclusive gas sensors based on an orbital-energy-matching framework.

Keynote Speaker

14:30-15:00

Ting Zhang

Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences

Bio: Ting Zhang is a full professor, and deputy director of Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences. He also serves as the associate editor of Microsystems & Nanoengineering, Lifetime Fellow of the International Association of Advanced Materials (IAAM), Deputy Director of the Professional Committee on Intelligent Wearable Technology, Chinese Institute of Command and Control, etc. His research interests include flexible electronics, biomimetic smart sensing technology, neuromorphic technology, and wearable smart microsystems, as well as exploring their innovative applications in brain-machine interface, embodied intelligence, smart healthcare, and other related fields. He has published more than 150 peer-review papers as the first/corresponding author in journals like Science Advances, Nature Communications, Advanced Materials, etc., and has applied more than 100 patents. He got the National Natural Science Foundation for Distinguished Young Scholars of China in 2021, the Excellent Supervisor Award of Chinese Academy of Sciences in 2020, the Young Science and Technology Talent Award of China Instrument and Control Society (2016), etc.

Title: Smart Flexible Sensing Electronics and Applications

Abstract: Smart wearable flexible sensing devices are important core components of information systems in the post-Moore's Law era., involving interdisciplinary research fields such as sensitive electronics, materials science, mechanics, micro/nano fabrication technologies, and artificial intelligence. It is of great scientific significance to develop new materials, principles, and innovative designing methods for wearable flexible sensing devices, and to realize the application of these devices in the fields of intelligent robotics, wearable devices, and brain-computer interfaces, etc. In this talk, I will present our recent progress in developing smart flexible wearable sensing devices. These sensing devices include multi-modal flexible biomimetic tactile sensors and highly biocompatible flexible neural electrodes and brain-computer interface sensors. The innovative designs of the flexible biomimetic sensitization structures and sensor devices to achieve high-sensitivity, high-stability real-time detection of the tactile information and Electroencephalogram/Electromyography signals will be discussed. The discussion will extend to the integration of wearable intelligent systems and their applications in humanoid robots/prosthetic hands, smart healthcare, smart sports and other fields. The challenges and opportunities in the engineering and applications of smart flexible sensing devices will also be discussed.

Keynote Speaker

15:00-15:30

Wei Zhou

Xiamen University

Bio: Wei Zhou received his Ph.D. degree in Mechanical Engineering from South China University of Technology in 2010. From 2010 to 2012, he worked as a faculty postdoctoral fellow at Sun Yat-sen University. He is currently a Professor at Xiamen University and serves as Associate Dean of the Pen-Tung Sah Institute of Micro-Nano Science and Technology. His research interests include functional microstructure manufacturing, precision manufacturing technologies, high-efficiency hydrogen production, microchannel reactors, hydrogen fuel cells, loop heat pipes and heat exchangers, intelligent cutting tools, and intelligent sensors.

Prof. Zhou has published over 200 peer-reviewed journal papers and holds more than 120 patents. He has led over 50 national and provincial level research projects, including the National Science Fund for Distinguished Young Scholars, the National Science Fund for Excellent Young Scholars, key projects of the National Regional Innovation Joint Fund, National Key R&D Program projects, and major science and technology initiatives of Fujian Province. His honors include the first prize of the Fujian provincial science and technology progress award, the second prize of the ministry of education of China technology invention award, the first prize of the Xiamen science and technology progress award, and the Xiamen outstanding science and technology innovation talent award, etc.

Title: Laser Manufacturing Technology for Intelligent Sensors

Abstract: Intelligent sensors integrate sensing, data processing, and communication functions. Introducing microstructures such as cones, micropillars, pyramids, and porous structures into sensors can

significantly enhance their performance, including sensitivity and measurement range. However, the fabrication of three-dimensional microstructures for intelligent sensors remains challenging. Owing to its advantages of non-contact processing, high precision, and strong material adaptability, laser manufacturing technology has been widely applied in microstructure fabrication. This report focuses on laser manufacturing technologies of different microstructures for intelligent sensors, discusses recent advances in microstructure fabrication processes and underlying processing mechanisms, novel sensor design strategies, and integrated applications in human – machine interaction, and outlines future research directions in sensor manufacturing technologies, sensor performance optimization, and integrated applications.

Technical Sessions

D2-PM-A12: Advanced Optical Nanometrology and Nanoscopy

13:30-15:00, April 18, 2026 **Convention Hall C**

Session Chair: Jinlong Zhu, Huazhong University of Science and Technology

Keynote Speaker

13:30-14:00

Kebin Shi

Peking University

Bio: Dr. Kebin Shi received his Bachelor's and Master's degree from Nankai University in 1998 and 2001 respectively. He received his Ph.D degree in Electrical Engineering at the Pennsylvania State University in 2007. Dr. Shi joined faculty members at Peking University in the Institute of Modern Optics in July 2011. His research focuses on developing high resolutioin photonic systems and devices based on ultrafast/nonlinear optical principles for spectroscopy, imaging and applications. His recent research interests include super-resolution imaging, nonlinear holography and femto-second frequency comb metrology. He currently serves as a co-chair of conference committee for "Ultrafast Imaging and Spectroscopy Conference" at SPIE Optics + Photonics meeting. In 2013, Dr. Shi was awarded "National Natural Science Funds for Excellent Young Scholar" by National Natural Science Foundation of China (NNSFC). He has authored or coauthored more than 100 refereed journal papers with over 3000 citations (h-index: 30), and has delivered over 50 invited talks/seminars in international or domestic conferences/universities. His scientific achievements also include ~20 granted patents. He currently serves as deputy editor of Optics Express.

Title: High Resolution Optical Imaging Enabled by Field Engineering

Abstract: Optical imaging has been playing important roles in modern physics and engineering. The unique capability of high resolution in both temporal and spatial dimensions make optical imaging technologies essential elements in various interdisciplinary researches. Many outstanding imaging technologies are developed based on the fusion of basic optical-physics mechanisms and engineering implementations. In this talk, the introduction to fundamental concepts enabling highly spatiotemporal resolution will be discussed, followed by the examples in engineering applications including novel label free imaging and tomographic metrology.

Invited Speaker

14:00-14:20

Qun Yuan

Nanjing University of Science and Technology

Bio: Qun Yuan is currently a Professor and PhD Supervisor at the School of Electronic and Optical Engineering, Nanjing University of Science and Technology, where he also serves as Vice Dean of the School. He has been selected for the National High-Level Young Talents Program in recognition of his academic achievements and research potential. His research mainly focuses on precision optical testing and advanced optical design, with particular interest in developing innovative optical methods and technologies for high-precision applications. Prof. Yuan has undertaken and participated in a number of important scientific research projects, including those supported by the National Natural Science Foundation of China and the National Key Research and Development Program of China. Prof. Yuan has authored more than 30 papers in leading journals such as Light: Science & Applications, ACS Photonics, and Optics Letters. In addition, he serves as an Editorial Board Member of Infrared and Laser Engineering and as a Young Editorial Board Member of Acta Photonica Sinica and Acta Optica Sinica.

Title: Near-Infrared Coherence Scanning Interferometry for 3D Metrology of High-Aspect-Ratio Microstructures

Abstract: Accurate and non-destructive three-dimensional (3D) characterization of high-aspect-ratio (HAR) microstructures is increasingly important for semiconductor manufacturing, micro-electro-mechanical systems (MEMS), and advanced microfabrication. However, optical measurement of HAR and composite microstructures remains challenging because conventional visible-light methods suffer from limited penetration, severe sample-induced aberrations, and low signal-to-noise ratio at the trench bottom. In this presentation, I will introduce our recent progress in near-infrared coherence scanning interferometry for 3D optical detection of HAR microstructures. By exploiting the transmission of near-infrared light through silicon, the proposed approaches enable access to buried and deep structural information that is difficult to obtain using traditional interferometric techniques. Firstly, the physical mechanisms of sample-induced aberrations will be discussed in single trenches and trench arrays, together with modeling methods that combine rigorous electromagnetic analysis and diffraction theory. Then the aberration-compensation strategies will be proposed to improve topography reconstruction accuracy at the trench bottom. Finally, I will introduce our Fourier ptychographic coherence scanning interferometry approach, which further enhances signal-to-noise ratio and lateral resolution for HAR and composite microstructures. Experimental results on silicon trenches and MEMS devices with aspect ratios up to 30:1 demonstrate the potential of these methods as robust metrology tools for next-generation micro- and nanomanufacturing.

Invited Speaker

14:20-14:40

Jinlong Zhu

Huazhong University of Science and Technology

Bio: Jinlong Zhu received his BS degree and PhD in Mechatronic Engineering from Huazhong university of Science and Technology in 2015. From 2015 to 2020, he worked as postdoctoral researcher at the University of Illinois at Urbana-Champaign until he started his appointment of Professor with Huazhong University of Science and Technology in 2021. He conducts research in basic science and engineering at the intersection of optical physics, nanodevices, semiconductor IC chips, and machine learning. He is particularly interested in the application of tools, knowledge and insights from photonics, nanoscience and physics to the design of optical imaging instruments and photoelectronic integrated systems for the noninvasive exploration of nanoworld.

Title: Advanced Semiconductor Patterned Wafer Defect Inspection Techniques

Abstract: The growing demand for electronic devices, smart devices, and the Internet of Things constitutes the primary driving force for marching down the path of decreased critical dimension and increased circuit intricacy of integrated circuits. However, as sub-10 nm high-volume manufacturing is becoming the mainstream, there is greater awareness that defects introduced by OEM components impact yield and manufacturing costs. The identification, positioning, and classification of these defects, including random particles and systematic defects, are becoming more and more challenging at the 10 nm node and beyond. Very recently, the combination of conventional optical defect inspection with emerging techniques such as nanophotonics, optical vortices, computational imaging, quantitative phase imaging, and deep learning is giving the field a new possibility. Hence, it is extremely necessary to make a thorough review for disclosing new perspectives and exciting trends, on the foundation of former great reviews in the field of defect inspection methods. In this presentation, we give a comprehensive review of the emerging topics in the past decade, alongside a detailed description of the in-house developed novel phase imaging techniques for semiconductor metrology and inspection.

Technical Sessions

D2-PM-A13: Award Finalist Session: Best Student Paper

13:30-15:45, April 18, 2026 **Convention Hall D**

Session Chairs: Yu Song, CUHK; Bo Meng, SZU

13:30-13:45	**Paper ID:** Oral# 16 **Paper Title:** A Separated Wheatstone Bridge Sensor with a High Sensitivity of Torsion Angle Applied for Mems Mirrors **Presenter:** Penghong Shi, Harbin Institute of Technology
13:45-14:00	**Paper ID:** Oral# 32 **Paper Title:** Ai-Based Grid Binary Annotation for Automated Recognition of Exfoliated Monolayer Mos_2 **Presenter:** Zihan Lin, The Hong Kong University of Science and Technology (Guangzhou)
14:00-14:15	**Paper ID:** Oral# 35 **Paper Title:** A 3D Interconnected Flexible Thermocouple Array with High Spatial Resolution **Presenter:** Yingying Dai, Xiamen University
14:15-14:30	**Paper ID:** Oral# 36 **Paper Title:** Flexible Piezoresistive Pressure Sensor Based on Axially Stiffness-Graded Microcone Arrays **Presenter:** Yu Han, Xiamen University
14:30-14:45	**Paper ID:** Oral# 38 **Paper Title:** High-Performance Magnetoelastic Generators for Wearable Power Supply and Ultrasonic Energy Harvesting **Presenter:** Jiaqi Lu, Zhejiang University
14:45-15:00	**Paper ID:** Oral# 44 **Paper Title:** Battery-Free and Multiplexed Photonic Sensor Patch for Wound Monitoring **Presenter:** Jiayue Gu, ShanghaiTech University
15:00-15:15	**Paper ID:** Oral# 49 **Paper Title:** A Force-Feedback Assisted Adaptive Current Threshold Adjustment Method for Scanning Ion Conductance Microscopy **Presenter:** Hongyu Wang, Shenyang Institute of Automation Chinese Academy of Sciences
15:15-15:30	**Paper ID:** Oral# 64 **Paper Title:** Development of a Magnetic Microrobot Actuation System with Spherical Rotating Permanent Magnet **Presenter:** Hanwen Zhang, Beijing Institute of Technology
15:30-15:45	**Paper ID:** Oral# 408 **Paper Title:** MEMS Differential Thermopiles for High-Performance Acetylene Gas Detection **Presenter:** Jingjing Yang, Shanghai Institute of Microsystem and Information Technology

Technical Sessions

D2-PM-B01: Micro/Nano Energy Devices and Self-Powered Systems

16:00-18:00, April 18, 2026 **Meeting Room 301A**

Session Chair: Bo Meng, Shenzhen University

Invited Speaker

16:00-16:20 **Lu Wang**

Xi'an Jiaotong University

Bio: Wang Lu, Associate Professor at the School of Instrument Science and Technology, Xi'an Jiaotong University. His main research is piezoelectric device and energy harvesting technology for self powered wireless sensors. He is committed to theoretical analysis, device design and manufacturing of vibration and electromagnetic field energy harvesting. Research on the application of power management and self powered wireless sensing systems. He presided over seven projects, including the National Natural Science Youth Fund, the sub project of the National Key Research and Development Program, the project of the Boxing Innovation Program, the horizontal project of the State Grid, the project of the State Key Laboratory, and the Youth Fund of Shaanxi Province. Published 37 SCI and EI papers in internationally renowned journals such as Applied Energy, Nano Energy, ACS sensors, MSSP, ACS AEM, IEEE TIM, and SNA, applied for 28 invention patents (11 authorized), participated ,gave 12 oral presentations in international conferences. He was awarded National Postdoctoral Innovation Talent Program, the Shaanxi Province Excellent Doctoral Dissertation and the 2023 MINI Outstanding Young Scientist Award.

Title: Multisource Energy Harvesting System for Wireless Sensing in Power Grid

Abstract: To address the core challenges of wireless sensor nodes in power grid digital transformation—difficult power supply, high maintenance costs, and poor adaptability—the system proposes a series of self-powered wireless sensing solutions utilizing multi-source energy from magnetic fields, electric fields, vibrations, photovoltaic, and wind energy. Leveraging abundant environmental energy in power grid scenarios, the system conducts in-depth research on multi-field coupled energy conversion mechanisms: Magnetic field energy harvesting employs "adaptive capacitive compensation + thyristor discharge" technology, overcoming the 2A-10kA wide current adaptation bottleneck with output power ⩾20W at 100A; Electric field energy harvesting optimizes plate-type structures and multi-stage under-voltage locking circuits, achieving output power ⩾9mW at 110kV; Vibration energy harvesting utilizes optimized L-shaped piezoelectric oscillator structures and broadband frequency expansion designs, compatible with 5-150Hz vibration scenarios with output power ⩾ 29mW at 0.2g/50Hz; Photovoltaic-wind energy harvesting combines perovskite solar panels with small-scale piezoelectric wind collectors to achieve complementary power supply in low-light and low-wind-speed environments. The system innovatively

designs an adaptive multi-source energy switching and hybrid energy storage management system, implementing dynamic energy allocation through voltage comparison and MPPT algorithms, combined with low-power wireless sensor node integration, forming a closed-loop "energy harvesting-energy storage-energy utilization-energy transmission" cycle. Experimental and grid-connected tests verify stable operation under wide current, strong electromagnetic, and complex climate conditions, enabling multi-parameter monitoring of current, temperature/humidity, and vibration with data transmission intervals ⩽32s, reducing O&M costs by over 60%. This system provides sustainable energy solutions for full-state monitoring of smart grid transmission and transformation equipment, facilitating the digital and low-carbon upgrade of new power systems.

Invited Speaker

16:20-16:40

Guanlin Liu

Guangxi University

Bio: Guanlin Liu received a B.S. degree (2014) and a Ph.D. degree (2019) in physics from Chongqing University. He was a visiting scholar at Georgia Institute of Technology through the program of China Scholarship Council, and now is an associate professor of physics at Guangxi University.His main research interest focuses on triboelectric nanogenerators for blue energy harvesting.

Title: Wave Energy Triboelectric Nanogenerator With High-Density Triboelectric Layers

Abstract: Triboelectric nanogenerators (TENGs) are one of the potential technologies for efficiently harvesting low-frequency and high-entropy wave energy. Low cost and high output are also the key characteristics determining their future large-scale commercialization. This report will introduce a series of TENGs based on silicon-manganese spring steel sheets. The aim is to obtain a larger area of triboelectric layers within a unit space through appropriate structural design and spatial layout, while reducing reliance on other auxiliary materials. Ultimately, this will enable TENGs to achieve high output, low cost, and light weight, allowing them to better respond to and harvest wave energy.

Invited Speaker

16:40-17:00

Qilin Hua

Beijing Institute of Technology

Bio: Qilin Hua is currently a professor at the School of Integrated Circuits and Electronics, Beijing Institute of Technology. His research interests include flexible/stretchable electronics, nanoelectronics, and neuromorphic engineering. He has authored more than 80 peer-reviewed publications in leading journals, including Nature Communications, Advanced Materials and Chemical Society Reviews, accumulating over 4,200 citations, with a single paper cited more than 1,480 times. His representative works have been recognized as ESI Highly Cited Papers, China's Top 100 Most Influential International Academic Papers (2018), IEEE EDSSC 2025 Excellent Paper, etc. He currently serves as

Young Editorial Board Member for journals, such as Nano Energy, Soft Science, Information & Functional Materials, SmartSys, and Nanotechnology and Precision Engineering.

Title: Neuro-inspired Artificial Sensory Systems for Embodied Intelligence

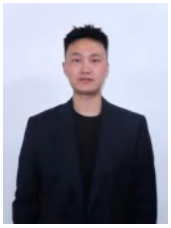
Abstract: As we enter a new era of intelligence, the urgent demand for advanced bio-inspired electronic devices is rapidly increasing, driven by the Internet of Things (IoT) and artificial intelligence (AI). Traditional electronic systems, operating under conventional computing architectures, face persistent challenges related to energy efficiency, memory limitations, and scaling constraints. Currently, memristor-based neuromorphic devices have emerged as promising solutions, showcasing remarkable capabilities for efficiently implementing complex data processing tasks by emulating the synaptic and neuron functions of the human brain. Inspired by neuron models, artificial sensory systems have developed and found applications in diverse fields such as humanoid robots, electronic skin, and brain-computer interfaces. Of particular interest are artificial receptors that exhibit biologically complex sensory functions, holding significant potential in the expanding domains of humanoid robotics and intelligent prosthetics. However, conventional artificial sensory systems, with the separation of sensors, memory units, and processing components, present serious challenges in terms of device integration, efficiency, and power consumption. In this talk, we will demonstrate the neuro-inspired artificial sensory systems featuring with memristors based on piezoelectric, piezoionic, or thermoelectric effect. This development marks a notable stride towards realizing neuro-inspired receptors, and will enable a new paradigm of intelligent perception in neuromorphic engineering.

Invited Speaker

17:00-17:20

Wei Xu

Nanjing University of Posts and Telecommunications



Bio: Wei Xu earned his bachelor's and doctoral degrees from Beijing Jiaotong University. During his doctoral studies, he conducted visiting research at the Microsystems Laboratory of École Polytechnique Fédérale de Lausanne (EPFL). Since 2023, he has been appointed to the Department of Electronic Science and Technology (a discipline under the national "Double First-Class" initiative) at the College of Electronic and Optical Engineering & College of Flexible Electronics (Future technology), Nanjing University of Posts and Telecommunications. His research focuses on the charge release dynamics of triboelectric nanogenerators and their coupling mechanisms with biological interfaces, with the long-term goal of leveraging triboelectric effects to empower bio-interfaces and establishing a new paradigm for the precise delivery of bioactive substances across interfaces. In this field, he has published over 10 SCI papers in journals such as ACS Sensors and Nano Energy, with an h-index of 11 (Google Scholar).

Title: Triboelectric Interfaces: Bridging Human-Machine Interaction

Abstract: Triboelectric nanogenerators (TENGs) have emerged as a compelling platform for actively modulating bio-interfaces and enabling next- generation human- machine interaction. This talk will

present our recent work on leveraging TENG- driven charge dynamics to establish two innovative interfacial systems.

In the context of human- machine interaction, we introduce a channel- simplified touch panel that utilizes TENG principles to achieve tactile input. By redesigning the sensing architecture, this system significantly reduces wiring complexity and signal crosstalk while maintaining robust multi- touch detection, offering a scalable and cost- effective solution for wearable and flexible interactive devices.

For bio- interfaces, we demonstrate a TENG- based wireless transcutaneous transmission coil designed to precisely drive the delivery of triboelectric signal across skin barriers. This approach harnesses controlled triboelectric potentials to generate localized electric fields, enabling on- demand, spatiotemporally accurate transport of energy without invasive procedures.

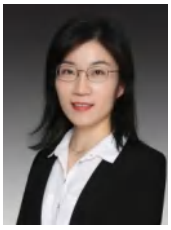
By merging fundamental charge- release dynamics with applied device design, we aim to advance toward a new paradigm where TENGs serve as intelligent mediators for enhanced biosensing, therapeutic delivery, and seamless human- device integration.

Invited Speaker

17:20-17:40

Lingyun Wang

Shandong University



Bio: Dr. Lingyun Wang received her PhD degree from City University of Hong Kong in July 2019. Then, she worked as a Postdoc Fellow at the Chinese University of Hong Kong and City University of Hong Kong. Afterward, she joined Shandong University as a professor and was recognized as a Taishan Scholar and an outstanding overseas Young Talent of Shandong Province. Currently, her research interests mainly focus on functional (bio)materials and their applications in flexible/wearable smart devices, including epidermal bioelectronics for human health monitoring, flexible sensors for IoT applications, and flexible energy harvesters for wearable electronics. Dr. Wang's research has been published in top-notch journals, including Advanced Materials, Advanced Energy Materials, Advanced Functional Materials, ACS Nano, Nano Energy, etc. She serves as an Associate Editor of Frontiers in Electronics: Wearable Electronics, Youth Editorial Board Member of Nano-Micro Letters, Soft Science, and Research.

Title: Wearable Polymer Composite Triboelectric Nanogenerators and Their Self-powered Sensing Performance

Abstract: Functional polymer composites are crucial for advancing wearable triboelectric nanogenerators (TENGs) to meet the increasing demand for enhanced performance and multifunctional capabilities. The composition and structure of these materials significantly influence their mechanical and electrical properties. Here, we optimize composite performance by integrating two-dimensional graphdiyne, lead-free bismuth halide perovskite, and n-type conductive polymer into polymer matrices through various fabrication methods, including casting and solvent extraction, electrospinning, and solvent casting. These approaches enable the development of porous polymer composites, nanofibrous films, and bi-continuous composites. By meticulously adjusting the fabrication parameters, we thoroughly

investigate the physicochemical properties of these composites and establish their relationship with performance in micro energy harvesting applications. Leveraging their unique properties, we demonstrate a range of self-powered sensing applications, such as respiratory monitoring, Morse code detection, volatile organic compounds detection, fall alarms, and track recognition. These findings highlight the significant potential of these materials in wearable electronics and on-skin human-machine interfaces.

Invited Speaker

17:40-18:00

Xiuhan Li

Beijing Jiaotong University

Bio: Xiuhan Li is currently a Professor at Beijing Jiaotong University (BJTU). She received her Ph.D. degree in Microelectronics and Solid-State Electronics from Peking University in 2006, and then she joined the School of Electronics and Information Engineering (BJTU). She also was the visiting scientist of the Institute of Microelectronics in Peking University from 2006 to 2013. Her research interests include Micro/nano devices and energy harvesting, implantable biomedical microdevices and its integrated system. She has directed and participated in a number of projects from the Ministry of Science and Technology, NSFC, BJNSFC, etc.

Prof. Li has published more than 30 peer-reviewed papers (Adv. Mater., ACS Nano, Nano Energy, etc.) and authorized 6 invention patents. She also serves as referee for several highly-reputable journals (Nano Energy, IEEE Trans. Power Electron., IEEE trans. Ind. Elecron., IEEE Trans. Antennas Propag., IEEE Trans. Nanotechnol., etc.). She is also hosting the undergraduate courses of "Semiconductor devices and physics" and "Integration Circuits Process Principle".

Title: Self Powered Nano Fiber Based Wearable Sensors for IOT

Abstract: Flexible film offers unique advantages for wearable devices due to their adaptability to dynamic human motions and compatibility with skin-like interfaces. However, beyond flexibility, high electrical output and reliable performance are also essential for practical applications. To address these requirements, research efforts have been directed toward advancing the core elements of flexible triboelectric devices, particularly the triboelectric materials, through three key strategies: First, electrospinning has been employed to fabricate nanostructured films with large surface area and enhanced charge-trapping capability, enabling superior triboelectric performance. Second, composite engineering has been utilized by incorporating functional fillers, such as rare earth oxides or biopolymers, to tailor dielectric properties and surface chemistry, thereby improving charge density and output efficiency. Third, system-level integration has been achieved through structural optimization and multi-channel sensor networks, which enhance device functionality and facilitate practical applications in wearable healthcare and intelligent monitoring. These advances establish a comprehensive framework from material innovation to biomedical applications, highlighting the potential of flexible triboelectric nanogenerators as sustainable and multifunctional platforms for next-generation wearable electronics and clinical rehabilitation.

Technical Sessions

D2-PM-B02: Emerging Electromechanical Transduction and Multimode Sensing

16:00-18:00, April 18, 2026 **Meeting Room 301B**

Session Chair: Hengyu Guo, Chongqing University

Invited Speaker

16:00-16:20 **Gang Cheng**

Henan University

Bio: Gang Cheng, male, born in January 1978, is a Professor and Doctoral Supervisor. He is a recipient of the National Excellent Youth Science Fund, recognized as a Science and Technology Innovation Leading Talent under the Central Plains Thousand Talents Program of Henan Province. He also leads a university science and technology innovation team in Henan Province, and has been honored as an Outstanding Youth in Science and Technology Innovation and an Academic and Technical Leader of the province. Additionally, he serves as an Executive Council Member of the Physical Society of Henan Province. He earned his Bachelor's degree in Physics from Henan University in 2000, followed by a Master's degree in Condensed Matter Physics from the same university in 2003. He completed his Ph.D. in Condensed Matter Physics at Jilin University in 2008. He began his research career in 2003 at the Key Laboratory of Special Functional Materials (Ministry of Education) at Henan University and was a Visiting Scholar at the Georgia Institute of Technology, USA, from 2013 to 2016. His research over the years has focused on low-dimensional nanostructured optoelectronic devices, conducting systematic work on nanostructure fabrication, characterization of surface and interface photoelectric properties, and the development of optoelectronic nanodevices. His key research developments include novel devices such as Schottky barrier optoelectronic nanodevices, triboelectric nanogenerators, and self-powered optoelectronic nanodevices. He has published over 40 SCI-indexed papers in prestigious journals including Advanced Materials, Advanced Energy Materials, Advanced Functional Materials, Angewandte Chemie International Edition, Nano Energy, ACS Nano, and Applied Physics Letters. He has served as the Principal Investigator for 4 projects funded by the National Natural Science Foundation of China and 3 provincial/ministerial-level projects. His achievements include receiving the Henan Province Science and Technology Progress Award (Second Class) twice and holding 14 authorized national invention patents

Title: Self-Powered Sensing System and Wearable Health Devices Based on Triboelectric Nanogenerator

Abstract: Wearable smart sensors face limitations due to bulky batteries and limited lifespan. The triboelectric nanogenerator (TENG), which harvests mechanical energy, offers a promising solution for

self-powered systems. This work presents three key developments. First, a self-powered wireless sensing system (SP-WSS) is developed, achieving an ultra-low energy consumption of 9 μJ per sensing-communication cycle. It enables real-time pressure sensing with a communication frequency of 72.55 MHz and a 40 m signal transmission distance. Second, a self-powered wireless pressure sensor based on a capacitive triboelectric pressure sensor (CTPS) is fabricated. The CTPS integrates pressure sensing and wireless transmission, exhibiting a high sensitivity of 78.78 V • kPa^{-1}, a fast response time of 20 ms, and a low detection limit of 6.53 Pa. Third, a plantar pressure sensor array and gait analysis system using a flexible triboelectric pressure sensor (FTPS) array is constructed. The integrated insole with 32 FTPSs, paired with a long short-term memory neural network, achieves a gait judgment accuracy of 94.23%. These advances demonstrate the significant potential of TENG-based technology for next-generation wearable electronics.

Invited Speaker

16:20-16:40

Minyi Xu

Dalian Maritime University

Bio: Minyi Xu holds a Ph.D. in Science from Peking University and is a professor at Dalian Maritime University. His research focuses on underwater operation and maintenance support for marine infrastructure and transport equipment. He has published over 200 academic papers, been granted over 30 invention patents, and received over 10 provincial and ministerial-level honors and awards, including the First Prize of the Invention and Entrepreneurship Award from the China Association of Inventions and the First Prize of the Liaoning Provincial Higher Education Undergraduate Teaching Achievement Award. He serves as a formal delegate to the 10th National Congress of the China Association for Science and Technology, Vice Chairman of the Robotics System Simulation Professional Committee of the Chinese Society for Simulation, a member of the Marine Technology and Equipment Professional Committee of the Chinese Society for Oceanography, and a member of the Youth Editorial Board of the Journal of Underwater Unmanned Systems.

Title: Biomimetic Fish Lateral-Line Sensor Based on Triboelectric Nanogenerator for Underwater Flow Field Information Perception

Abstract: Underwater flow monitoring technology is becoming increasingly important in fields such as marine environmental perception and marine engineering. Traditional underwater sensors often rely on external batteries or cables for power, resulting in complex systems, high maintenance costs, and potentially rapid energy consumption during long-term monitoring. Therefore, there is an urgent need for monitoring technologies that do not require external power, are environmentally friendly, and have strong adaptability. The lateral line system is a crucial sensory organ in fish. It can accurately detect tiny disturbances in water flow, providing insights into the development of underwater sensors. However, existing biomimetic sensors still suffer from limited sensing functions, complex structures, and high maintenance costs. Triboelectric nanogenerator (TENG) technology, based on triboelectric charging and electrostatic induction, can convert tiny mechanical disturbances into electrical signals, offering

advantages such as simple structure and low cost. Its application in marine engineering is increasing. This technology offers new approaches for the design of autonomous and multifunctional underwater sensors. To this end, this paper proposes a biomimetic fish lateral-line sensor (BFLS) based on a triboelectric nanogenerator. Experimental results show that BFLS can effectively sense underwater flow field characteristic parameters. The generated electrical signal exhibits a high linear relationship with the underwater flow velocity. This indicates that BFLS has broad application prospects in the field of underwater flow field monitoring.

Invited Speaker

16:40-17:00

Qiongfeng Shi

Southeast University

Bio: Qiongfeng Shi is currently a Professor at Southeast University. He received his B.Eng. degree from University of Science and Technology of China and Ph.D. degree from National University of Singapore. He then worked as a Research Fellow at NUS from 2018 to 2022. His research interests include flexible electronics, multimodal sensors, energy harvesting, human-machine interfaces, MEMS, and intelligent systems. He has hosted and participated in many research grants, and published >110 SCI journal papers (>60 papers as first/co-first/corresponding author) in Nat. Commun., Sci. Adv., Adv. Mater., Mater. Today, ACS Nano, etc., including 12 ESI highly cited papers and 3 journal covers. He has made more than 10 invited talks in international academic conferences, and won a Best Conference Paper Award and a Best Poster Finalist Award. His work has been broadly recognized by the community and received more than 11,000 citations with an H-index of 60.

Title: Self-Powered Tactile Skins for Multimodal Sensing and Intelligent Interactions

Abstract: This study presents self-powered tactile skins designed to meet the demands of complex environments and diverse applications, with a focus on multimodal sensing, intelligent integration, and seamless human–machine interaction. A self-powered flexible triboelectric sensor is first developed by combining a two-dimensional grid structure for in-plane control with a one-dimensional ribbon for out-of-plane displacement. The system enables real-time 3D motion control of robotic manipulators with low cost and facile fabrication. Next, a biomimetic hairy tactile-sensing interface is proposed, inspired by human C-low threshold mechanoreceptors. Using a triboelectric mechanism and a four-electrode configuration, it achieves high force sensitivity and fine spatial resolution across a large area. Integrated with convolutional neural networks and large language models, the interface delivers precise gesture recognition and emotion recognition, supporting closed-loop affective interaction between humans and robots. Last but not least, a body-coupled interface is introduced, leveraging electromagnetic coupling together with resistive and capacitive sensing. This platform provides micrometer-scale 2D tactile sensing and broad 3D spatial perception, showing strong potential for object-oriented human–machine interaction. Collectively, these advances offer valuable insights for next-generation e-skins in wearable electronics, prosthetics, and humanoid robotics.

Invited Speaker

17:00-17:20

Zonghong Lin

National Taiwan University

Bio: Dr. Zong-Hong Lin received his PhD from the National Taiwan University (NTU) in 2009 and continued with his postdoctoral research at the NTU and the Georgia Tech during the years of 2010-2014. Subsequently, Dr. Lin joined the Institute of Biomedical Engineering, National Tsing Hua University (NTHU) as Assistant Professor in 2014 and was successfully promoted to Associate Professor and Full Professor in 2017 and 2021, respectively. In 2023, he moved to the Department of Biomedical Engineering at NTU. He has published more than 190 SCI papers, as well as received recognition for his research contribution, such as Wu Ho-Su Medical Award of the Taiwan Bio-Development Foundation (2025), Young Scholar Innovation Award of the Foundation of the Advancement of Outstanding Scholarship (2025), Outstanding Research Scholar of the Lee Chao-Jen Foundation (2024), CHEN-YUNG Chair Professor (2023) of NTU, Top 1% Outstanding Scholarly Publication Award of NTU (2025), Academic Excellence Award — College of Engineering of NTU (2023), Fellow of the Royal Society of Chemistry (2022), Outstanding Research Award of the Taiwan National Science and Technology Council (NSTC) (2023), Future Tech Award of the Taiwan NSTC (2021, 2022, 2023 and 2024), Ta-You Wu Memorial Award of the Taiwan NSTC (2021), Young Scholar Fellowship of the Taiwan NSTC (2020), IEEE-NANOMED New Innovator Award (2019) and Young Investigator Award of the NTHU (2018).

Title: Triboelectrification at Solid-Liquid Interfaces: Surface Chemistry-Driven Charge Transfer for Self-Powered Nanosensing

Abstract: Understanding charge transfer at material interfaces is a central issue in surface science and is critical for the development of next-generation functional devices. Triboelectrification, originating from interfacial contact and separation, provides a unique platform to study surface-dependent charge transfer while enabling energy-autonomous sensing. In this work, we present our recent advances in solid–liquid triboelectric nanosensors (SL-TENSs), with a particular focus on interfacial charge transfer mechanisms and surface chemistry regulation. By integrating triboelectrification with electrostatic induction, surface-engineered materials can convert interfacial physicochemical interactions into measurable electrical signals without external power sources. Unlike conventional solid-solid triboelectric systems, solid-liquid interfaces offer richer surface states, dynamic adsorption behaviors, and tunable electrical double-layer effects, making them highly suitable for probing surface-dependent phenomena. We demonstrate that selective adsorption or binding of target species, such as metal ions, small molecules, proteins, and microorganisms, modulates interfacial charge transfer characteristics, leading to distinct and quantifiable electrical responses. Systematic surface modification and material selection enable correlation between surface chemistry, interfacial charge density, and output signal evolution, establishing a clear sensing mechanism grounded in surface science. These results not only address key limitations of traditional triboelectric devices in stability and selectivity but also provide new insights into solid–liquid

interfacial electrification. This study highlights the potential of SL-TENSs as both practical self-powered sensors and experimental platforms for investigating interfacial charge transfer and surface phenomena.

Invited Speaker

17:20-17:40

Jun Dong

Ludong University

Bio: Prof. Dong Jun, a Taishan Scholar of Shandong Province, is the Principal Investigator of the Micro-Nano Electromechanical Chips and Intelligent Systems Group at the College of Integrated Circuits, Ludong University, leading a provincial high-level talent team. His research focuses on the pioneering development of liquid-solid interfacial total-current nanogenerators, covering a complete chain from physical theory, device architecture, material processing, power management circuits, to self-powered integrated systems. Over the past five years, he has led the National Natural Science Foundation for Young Scholars and a provincial high-level talent engineering project. With 37 publications and 627 citations, his work has appeared in top-tier journals including Device (a sister journal of Cell), Energy & Environmental Science, and Nano Energy. He has contributed 2 book chapters to monographs published by CRC Press and Chongqing University Press, holds 3 authorized invention patents, and serves as a reviewer for Nano Energy, Energy, and other prestigious journals. His work on high-voltage DC droplet-based nanogenerators has been widely highlighted by renowned top-tier review journals and academic platforms with detailed graphic reports, attracted extensive international attention and collaborative invitations, and received positive coverage from science and technology news media.

Title: Total-Current Nanogenerators: Bridging Liquid-Solid Interface Physics and Self-Powered On-Chip Sensing

Abstract: The miniaturization of intelligent sensing systems demands sustainable on-chip power sources. Traditional nanogenerators often suffer from alternating current output and low energy conversion efficiency, limiting their practical integration with MEMS devices.

This presentation reports our studies on the total-current generation theory for liquid-solid interface energy conversion, focusing on the fundamental mechanisms of charge separation, transport, and collection in micro-nano systems. Based on these studies, we have developed a high-performance DC droplet-based nanogenerator with optimized device architecture and interface materials, and achieved multi-scenario energy harvesting and self-powered sensing applications. Related results have been published in high-quality journals.

We will showcase the systematic research spanning from the theoretical framework of Total-Current Nanogenerators (TCNG) to the design of charge shuttle architectures and power management circuits. Furthermore, we will demonstrate the practical applications of this technology in a bionic triboelectric tongue, a self-powered real-time acid rain monitoring platform, and intelligent liquid sensing and identification systems. This work not only advances the fundamental understanding of energy conversion at solid-liquid interfaces, but also breaks through the AC-DC conversion bottleneck of conventional

nanogenerators via an integrated high-voltage DC scheme for generation, conversion, and storage. It lays a solid technical foundation for the next generation of self-powered intelligent MEMS systems without complex power management modules and with efficient compatibility for microelectronic devices.

Invited Speaker

17:40-18:00

Jun Li

Tongji University

Bio: Jun Li is an Associate Professor in the Department of Electronic Science and Technology, School of Electronics and Information Engineering, Tongji University. Her research interests lie in micro/nanoelectronic devices and physical sensing systems, with particular emphasis on polymer dielectric materials, charge transport mechanisms, and self-powered sensing devices and system integration. More recently, her work has expanded toward high-impedance weak-signal readout in complex contact interfaces, self-powered multisensory fusion, and physics-constrained state reconstruction. She has authored more than 20 SCI-indexed papers as corresponding author in journals such as Device, Advanced Functional Materials, Nano Today (including an ESI Highly Cited Paper), and Nano Letters.

Title: From Device-Level Advances to System-Level Realization in Triboelectric Sensing

Abstract: Triboelectric sensing has emerged as a promising route toward self-powered tactile and interface sensing, where materials design and device engineering play key roles in determining output performance, mechanical compliance, and operational stability. Among various material platforms, conductive hydrogels are particularly attractive because they can simultaneously serve as compliant tribo-layers and electrodes, enabling simplified device architectures with desirable deformability. Our recent work shows that active rehydration can effectively mitigate performance degradation in conductive hydrogel-based triboelectric tactile sensors, thereby improving signal stability and supporting long-term operation.

Beyond device optimization, a central challenge is how to translate improved device performance into practical sensing capability. This issue becomes especially important in complex contact scenarios, where triboelectric signals are shaped by dynamic interfacial interactions and coupled physical processes.

In this talk, I will present recent progress in hydrogel-based triboelectric devices and discuss the broader transition from device-level advances to system-level realization in triboelectric sensing. Particular attention will be given to signal reliability, information integration, and the need for more robust and interpretable self-powered sensing platforms for practical applications.

Technical Sessions

D2-PM-B03: Micro/Nano Sensing-Memory-Computing Devices

16:00-18:10, April 18, 2026 **Meeting Room 301C**

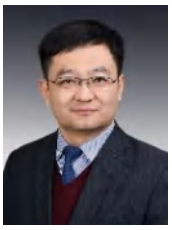
Session Chair: Shiquan Fan, Xi'an Jiaotong University

Keynote Speaker

16:00-16:30

Ming Liu

Xi'an Jiaotong University



Bio: Ming Liu received his Ph.D. degree from Northeastern University, Boston, USA, in 2010. He was a Research Fellow with the Argonne National Laboratory, Illinois, USA, from 2010 to 2013. He is currently serving as a distinguished professor and the Dean of the School of Electronics Science and Engineering and the Vice Dean of the Graduate School, Xi’an Jiaotong University, Xi’an, Shaanxi. Dr. Liu also serves as the Vice Director of the State Key Laboratory for Manufacturing System Engineering and holds other appointments in various academic organizations.

Prof. Liu has been involved in multidisciplinary research on applied magnetics, including spinelectronics, STT, SOT, and ME-based MRAM, TMR, and ME-based magnetic field sensors and ME antennas, flexible oxide functional materials and devices, and ferrites, ferroelectrics, and multiferroic materials and devices. He was a recipient of a few prestigious awards, including the Hundred Talents Program of Shaanxi (2016), the Clarivate Highly Cited Researcher (2019-2024), etc. He has published more than 280 papers in top-tier journals with 10000+ citations, including Science, Science Advances, Nature Communications, Advanced Materials, etc. His publication has been selected as one of the ten outstanding papers of the decade in Advanced Functional Materials.

Title: Research on Intelligent Sensing Technology and Applications for New Power Systems

Abstract: The development of new power systems demands intelligent monitoring in medium- and low-voltage distribution areas, where numerous nodes require real-time current sensing under complex outdoor conditions with wide-ranging amplitudes and frequencies. This calls for miniaturized sensors offering high sensitivity, wide bandwidth, broad range, and AC/DC measurement capability. In response, we developed a tunneling magnetoresistance (TMR) structure based on magnetic vortex states, yielding wide-range, low-power TMR chips, high-current modules, and metering chips with ultra-low hysteresis and strong anti-interference—achieving current sensors with <1‰ precision. Additionally, leveraging the magnetoelectric coupling effect, we fabricated ultra-sensitive magnetic field sensors and microampere-level weak current modules for high-sensitivity topology identification. Our detection-type current sensors have been deployed for distribution grid online monitoring, leakage current detection, and ground fault identification. High-precision current sensors won bids for China Tower’s energy

metering products and completed field trials. The topology identification system has been piloted in the "Distribution IoT Demonstration Zone" of Nanjing Jiangbei, achieving an accuracy exceeding 99%.

Invited Speaker

16:30-16:50

Yali Sun

Huazhong University of Science and Technology

Bio: Prof. Yali Sun is a recipient of the National Young Talent Program. She is a Doctoral Supervisor at the School of Artificial Intelligence and Automation, Huazhong University of Science and Technology. Her long-term research focuses on micro/nano photonics and its applications in biological detection. She has published over 25 research papers in prestigious academic journals such as Light: Science & Applications, Advanced Materials, Advanced Functional Materials, Laser & Photonics Reviews, Nano Letters, Advanced Optical Materials, and Analytical Chemistry. She has led the Russian Science Foundation's Outstanding Youth Project and participated in the BRICS Science, Technology, and Innovation Framework Program, as well as the China-Russia Intergovernmental Key Special Project on Science and Technology Cooperation. She has received multiple awards from international academic organizations, including the OSA Zuegel Family Scholarship, SPIE MKS Instruments Research Excellence Awards, ITMO University Academic Mobility, and the Best Poster Award at the International Conference on Nanophotonics and Micro/Nano Optics. She has delivered many invited and oral presentations at various international conferences. Additionally, she serves as a reviewer for academic journals such as Advanced Functional Materials and The Journal of Physical Chemistry Letters.

Title: Physics and Applications of Hybrid Nanophotonic Biosensors

Abstract: Hybrid nanophotonics are proven to be efficient systems for light controlling considering their ability to combine strong near-field localization via plasmonic resonances and inherent magnetic response via low-loss high-index dielectric nanostructures. Here fundamental studies of hybrid dimers are theoretically and experimentally investigated. By applying femtosecond laser to reshape the gold component of the hybrid nanostructure, tunable, reconfigurable, and enhanced optical properties are observed. Especially, all-optical generation of static electric field as high as 108 V/m is achieved at the interface between hybrid components by charge carriers generated via femtosecond laser irradiation and thus strongly enhanced second harmonic generation. Such hybrid nanostructure can be applied for unidirectional scattering, photoluminescence enhancement, optical sensing, and other applications. Besides, focused ion/electron beam method has been introduced to achieve hybrid chiral nanophotonic systems for biosensing. The chiral metamaterial provides a circular polarization-dependent optical response, allowing analysis in a complex environment without significant background interferences. At last, novel fabrication method-green printing technology has manufactured i) resonant 1D low-index nanostructures generated size-dependent structural colors through diffractive optical resonance, which has been utilized for colorimetric detection of multi-dimensional biomarkers (5nm-1 μ m). ii) hotspot engineered 3D hierarchical structures for single molecule level SERS detection of R6G and thus applied for ultrasensitive inflammatory marker detection.

Invited Speaker

16:50-17:10

Cong Wang

Nanjing University

Bio: Cong Wang is currently an Assistant Professor, Specially Appointed Researcher, and Doctoral Supervisor at the School of Artificial Intelligence. His primary research focuses on novel in-memory computing electronic devices, integrated circuit chips, and energy-efficient intelligent systems and applications. Over the past five years, he has published multiple first-author or corresponding-author papers in top-tier journals and conferences, including Nature Nanotechnology, Nature Electronics, IEDM, and Science Advances. His achievements include 9 authorized Chinese invention patents, 1 U.S. patent, 2 nominations for China's Top 10 Semiconductor Research Advances, 2 Silver Awards at the Geneva International Exhibition of Inventions, and 4 Best Poster Awards at major academic conferences (Nature Conference on Neuromorphic Computing, IEEE IWOFC2019, ICMIC2019, and the 24th National Conference on Semiconductor Physics). He also guided a team to win the National Special Award in the 18th "Challenge Cup" Academic Science and Technology Works Competition. He has been recognized with honors such as the "Postdoctoral Innovative Talents Support Program," "Yuxiu Young Scholar," and "Xiaomi Young Scholar." He has led research projects including the National Natural Science Foundation Youth Program, the China Postdoctoral Science Foundation General Program.

Title: Analog AI Computing Devices, Chips, and Applications

Abstract: From the slide rule invented in the sixteen hundreds to modern CMOS-based computers, each generation of computing tools has pushed the boundaries of what we can do. In the era of artificial intelligence, especially with the rise of deep learning, traditional computing tools are starting to hit fundamental limits. Therefore, we need to explore next-generation tools for future computing. Modern AI needs to perform large-scale real-time data processing, and the demand for computing has been exponentially increasing. However, the actual computing efficiency of traditional hardware, based on von Neumann architecture, is increasing very slowly. This gap has become one of the major challenges we face in the era of AI. A different computing paradigm, so-called analog/physical computing, can directly use physical phenomena for computing. We directly use voltage, current, and light as inputs; the physical system will work as a mathematical function, generating outputs. We only need to read the output, and the computations can be done. This approach can provide much higher energy efficiency than traditional methods. We will introduce some of our analog computing devices, chips and their applications.

Invited Speaker

17:10-17:30

Jiuren Zhou

Xidian University

Bio: Jiuren Zhou is a Professor and Ph.D. Supervisor at Xidian University. He has been selected for China ' s National Young Talent Program, recognized as a Xiaomi Young Scholar, and certified as a Category-B High-Level Talent of Hangzhou.

He received his B.Eng. and Ph.D. degrees from Xidian University under the supervision of Academician Yue Hao. During his doctoral training, he conducted joint research at the University of California, Berkeley, working with Prof. Sayeef Salahuddin and Prof. Chenming Hu, and later carried out research at the Silicon Nano Device Laboratory (SNDL) of the National University of Singapore. He is currently a core member of the research team led by Academician Yue Hao and Prof. Genquan Han at the Hangzhou Institute of Xidian University.

His research focuses on emerging ferroelectric memories, in-memory computing devices, and advanced computing chips. He has published over 100 papers in leading microelectronics journals and conferences, including IEEE IEDM, VLSI, EDL, and TED. He authored the monograph Negative Capacitance Field-Effect Transistors and holds more than 30 invention patents. He has led three national-level research projects, including a sub-project of the Science and Technology Innovation 2030 Program, and has received multiple academic honors.

Title: >1e10-Cycle Endurance in Wurtzite Ferroelectrics via a Superlattice and Recovery Protocol Enabling Vacancy Confinement

Abstract: Wurtzite-structured ferroelectrics offer distinct advantages for ultra-high-density, large-scale integrated memory due to their quasi-single-crystalline three-dimensional lattice architecture. However, their application is fundamentally constrained by endurance degradation under electrical cycling, with fatigue failure typically occurring before 108 cycles. The underlying microscopic mechanisms remain poorly understood. Here, we identify nitrogen vacancy (VN) clustering and long-range vertical migration as primary contributors to endurance breakdown. To address this, we design a spatially engineered AlScN/AlN superlattice coupled with a dynamic recovery protocol, jointly suppressing VN accumulation and mobility in both spatial and energetic domains. This combined approach stabilizes the defect distribution under high-field cycling, mitigating dielectric breakdown and polarization degradation. Consequently, we demonstrate ferroelectric endurance exceeding 1010 cycles in a wurtzite system — surpassing prior records by two orders of magnitude. This work clarifies the fatigue-inducing role of VN and establishes a structural – defect co-engineering strategy for highly reliable ferroelectric devices.

Invited Speaker

17:30-17:50

Xuge Fan

Beijing Institute of Technology

Bio: Xuge Fan is a professor and PhD supervisor at Beijing Institute of Technology (BIT) and is recipient of the National Natural Science Foundation of China's Excellent Youth Fund (Overseas). He obtained his PhD degree at the Royal Institute of Technology. He heads the research team of MEMS and NEMS and graphene Based 2D Materials in BIT with main research topics on MEMS/NEMS, micro-nano sensors, graphene, TMDCs and related 2D materials. He has pioneered the development of ultra-small, high-sensitivity graphene nanoelectromechanical accelerometer prototype devices.

Prof. Fan has published over 50 papers in high-quality journals and conferences such as Nature Electronics, Science Advances, Nano Letters, ACS Nano, CEJ, and Microsystems & Nanoengineering, and has been granted and applied for 16 Chinese invention patents. He has given nearly 20 invited presentations at academic conferences both domestically and internationally. He leads multiple projects and has long served as a reviewer for dozens of journals such as Nature Communications, ACS Nano.

Title: NEMS Sensors Based on 2D Membranes

Abstract: Graphene has atomically thin thickness and excellent mechanical and electrical properties such as high electron mobility, and high Young's modulus. Therefore, graphene has potential applications in micro-nano electromechanical systems (MEMS/NEMS), enabling the miniaturization and high performance of micro-nano electromechanical sensors. This report will first introduce the excellent characteristics of graphene and related 2D materials for NEMS and the basic development history of graphene NEMS sensors. Secondly, it will focus on the design, preparation, and characterization of NEMS transducers based on atomically thin suspended graphene and related 2D membranes with an attached proof mass, as well as their applications in ultra-small, high-performance nanoelectromechanical acceleration sensors and vibration sensors. Next, it will introduce NEMS pressure sensors based on suspended graphene and related 2D membranes and humidity sensors based on graphene and related 2D materials. Finally, it will discuss the potential advantages and challenges of 2D NEMS.

Invited Speaker

17:50-18:10

Jia Zhang

Harbin Institute of Technology

Bio: Dr. Jia Zhang is a full professor at the State Key Laboratory of Robotics and System in the Harbin Institute of Technology (HIT), China. He received doctor ' s degree in Mechanical Engineering at HIT in 2014. After that, he becomes a full faculty in HIT. Now, his research interesting is focused on the micro/nano fabrication of functional materials and structures for flexible electronics, including flexible electronics for robotics tactile sensor, Flexible and wearable devices, 3D printing for multi-materials. He is the recipient

of the Excellent Young Scholars award of NSFC (2021), the Young Elite Scientists Sponsorship Program by CAST (2015), and the First Prize of Natural Science by Heilongjiang Province (2015/2024). He has published more than 100 papers in Nature Electronics, Nature Communications, Advanced Materials, with the total citations over 4400. He currently serves as the editorial board member of International Journal of Extreme Manufacturing, Soft Science, SmartBot.

Title: Flexible Electronic Skins and Its Application in Human-Robot Collaboration

Abstract: Nowadays, intelligentization is one of significant trends for the developing of robotics. The key of this trend lies in the sensors for feeling and interaction with external environment. Among then, the vision sensing is the most mature, but there is still difficult to deal with various complex conditions involving human-machine interaction and cooperation alone. Therefore, it is urgent to develop tactile sensors for robotics. Flexible electronic device with their high performance, flexible, bending and other advantages, will play an important role in the robotics sensing. The report will reveal the needs of robot intelligent perception, analyze the key technologies in the design and manufacturing of several typical sensors, and review the recent research work of the research group.

Technical Sessions

D2-PM-B04: Micro/Nano Integrated Devices and Circuit Design

16:00-18:10, April 18, 2026 **Meeting Room 302A**

Session Chair: Yang Li, Shandong University

Keynote Speaker

16:00-16:30 **Linxi Dong**

Hangzhou Dianzi University

Bio: Linxi Dong is a Professor with the Smart Microsensors and Microsystems Engineering Research Center of Ministry of Education in the College of Electronics and Information of Hangzhou Dianzi University,
Hangzhou, China. His current research interests include industrial
Internet of Things, sensor peripheral processing IC design, micro-electro-mechanical system sensors, resonators, including design, and
modeling and fabrication of microstructures. He received the Ph.D.
degree (2004) in microelectronics and solid-state electronics at Zhejiang University, Hangzhou, China.

Title: A High-precision MEMS Force/Tactile Sensor Integrated Self-calibrating

Abstract: The rapidly expanding robotics industry has given rise to an imperative for high-performance tactile sensors that exhibit both high precision and long-term stability. However, existing tactile sensors are plagued by inherent limitations including performance degradation, hysteresis, and creep. Moreover, integrated self-calibration designs frequently entail trade-offs between functionality, miniaturization, and manufacturability. This paper puts forth a novel MEMS self-calibrating tactile sensor based on precision force source drive technology, which integrates high-performance force sensing and on-chip self-calibration capability. The study investigated the driving mechanism of PZT-driven double-clamped silicon piezoresistive beam. Utilizing the inverse piezoelectric effect of PZT, the integrated piezoelectric structure generates precise and controllable driving forces through the bending deformation of the double-clamped silicon piezoresistive beam. This effectively compensates for sensor performance drift without the need for additional off-chip calibration equipment.The tactile sensor is equipped with array comprising self-decoupled piezoresistive beams, facilitating the detection of forces along the X, Y, and Z axes. The driving mechanisms for the X and Y axes employ differential excitation, while the Z axis utilizes a single-electrode configuration. The findings reveal that the tactile sensor exhibits exceptional comprehensive performance, characterized by 0.496% FS accuracy, 0.43% FS hysteresis, 0.23% FS linearity error, 0.08% FS creep and a self-calibration error of just 0.92% within the 0 – 50% FS range. This work provides essential theoretical and technical support for intelligent robotic tactile sensing applications.

Invited Speaker

16:30-16:50

He Yu

Shandong University

Bio: Dr. He Yu was born in 1992, and she received her PhD degree in Information and Communication Engineering from Harbin Institute of Technology in 2021. In 2019, she was sponsored by the China Scholarship Council (CSC) as a visiting student at the Massachusetts Institute of Technology (MIT). To date, she has published more than 20 SCI papers in high-level journals, including Carbon, Advanced Functional Materials, ACS Sensors, and Sensors and Actuators B: Chemical. She is currently an assistant researcher at the School of Integrated Circuits, Shandong University. Dr. Yu has established several focused research directions, including functional sensing materials that prioritize high-sensitivity and biocompatible properties for practical healthcare applications, flexible wearable low-power integrated radio frequency (RF) electronics designed for human-machine integration, and compliant soft robotic systems with excellent adaptability to complex scenarios. Her research aims to enable reliable non-invasive health monitoring and provide effective assistance in clinical medical care by closely integrating materials science with electronic engineering technologies, thereby promoting the practical application of interdisciplinary technologies in the integrated wearable electronics field.

Title: From Rigid Integrated Passives to Flexible RF Wearables: Toward Next-Generation Integrated Intelligent Systems

Abstract: This talk presents a systematic research roadmap that progresses from functional nanomaterials, through rigid integrated passive RF devices and flexible RF integrated systems, toward human-machine interactive soft robotics. The work route begins with the foundational level of functional nanomaterials, we systematically investigate the structure property relationships and sensing mechanisms, achieving high performance wearable sensors with enhanced stability under complex conditions. Building on material insights, we design the rigid integrated passive RF devices fabricated on GaAs substrates. By integrating spiral inductors with hexagonal interdigital capacitors via multilayer air-bridge processes, we develop compact and high-Q microwave humidity sensors. These works establish a solid foundation for miniaturized RF circuits with low parasitic effects. Moving toward flexibility, we advance to flexible RF integrated systems. Using laser-induced graphene (LIG) as the conductive and sensing layer, we design a coplanar waveguide fed resonator that merges a spiral inductor with an interdigital capacitor. This structure achieves both mechanical flexibility and high RF sensitivity. Machine learning is further incorporated to decode multimodal motion signals, enabling accurate human-machine interaction. Inspired by ant motion mechanisms, we develop a soft robot driven by non-equibiaxial pre-stretched dielectric elastomers. Integrated with flexible RF sensors, this system realizes closed-loop control, demonstrating the potential of high integration between flexible RF sensing and soft actuation for next-generation intelligent systems.

Invited Speaker

16:50-17:10

Faheng Zang

Shanghai Jiao Tong University

Bio: Faheng Zang is an Associate Professor at the School of Integrated Circuits, Shanghai Jiao Tong University. He earned his B.S. and M.S. degrees from Shanghai Jiao Tong University in 2008 and 2011, respectively, and obtained his Ph.D. in Electrical and Computer Engineering from the University of Maryland, USA, in 2016. Prior to joining Shanghai Jiao Tong University in September 2021, Dr. Zang served as a Postdoctoral Research Associate at Princeton University and as a Principal Engineer at Goertek Electronics in the United States. He was recognized as an outstanding overseas talent under the Shanghai Municipal Government's High-Level Talent Program. His research focuses on nanophotonic devices, micro/nano biochemical sensors, and microsystem integration, with an emphasis on developing high-performance, label-free sensing platforms and integrated optofluidic systems. He has published extensively in top-tier journals such as Advanced Materials, Nature Communications, Advanced Functional Materials, Biosensors and Bioelectronics, and Chemical Communications, with multiple papers as first or corresponding author. His work advances miniaturized, real-time detection systems for biosensing and many physical sensing applications.

Title: Multiscale Integration of Photonic Micro-/Nano-Structures Toward In-Situ Sensing Applications

Abstract: In an increasing number of sensor application scenarios, it is required that sensors can be integrated seamlessly into targeted objects of interest without altering their intrinsic properties. These application-specific requirements can be quite important, such as identifying the strain distribution within a working flexible film, the temperature during chip bonding, the torque of a working rotary machine, to name just a few. Sometimes it is necessary not only to build sensors that are small and thin enough to fit into the system, but also to develop special integration methods to enable micro-/nano-fabrication directly on soft or curved object surfaces. This talk will demonstrate some new methodologies using multiscale integration to incorporate photonic structures on flexible and curved surfaces for stress and temperature sensing. We will discuss the possibility of adding micro-/nano-structured elements in many more in-situ sensing applications that are not feasible with traditional IC processes.

Invited Speaker

17:10-17:30

Hongsen Niu

University of Jinan

Bio: Associate Professor of School of Information Science and Engineering, University of Jinan, discipline leader, selected for the Special Program for Overseas Talent Attraction of the Ministry of Education, and Excellent Young Scholars of Shandong Province (Overseas). Main research areas: Design and preparation of intelligent tactile sensors; Design and integration of perception and cognitive systems; Advanced integrated circuit

manufacturing processes. In the past five years, he has published more than 40 SCI papers, including 25 SCI papers as the first/corresponding author in journals such as Adv. Mater. (*2), Adv. Funct. Mater. (*7), Nano Lett., Adv. Sci., and 6 ESI highly cited & hot papers.

Title: Micro/Nano-Morphological-Engineering-Based Bionic Tactile Sensors and Intelligent Cognition Systems

Abstract: Tactile perception refers to the ability to directly acquire contact/non-contact information through the human skin, which relies primarily on the unique and perfect biological structure inside and outside the skin. Furthermore, tactile cognition, as a deeper manifestation of tactile perception, converts the sensory information acquired by the skin into bioelectrical impulses, which are then transmitted to the central nervous system of the brain via afferent nerves. Through complex analysis, processing, and learning, deeper and more difficult-to-measure information can be obtained. Here, based on advanced micro-nano manufacturing technology and combined with bionic sensing technology, we develop tactile sensors and their cognition systems adapted to the process of intelligentization.

Invited Speaker

17:30-17:50

You Meng

Hunan University

Bio: Dr. MENG You is a Professor in the College of Semiconductor (College of Integrated Circuit) at the Hunan University. He received Ph.D. degree in Physics and Materials Science from the City University of Hong Kong. His research interests mainly focus on nanomaterials-based electronics and optoelectronics. So far, Dr. MENG has published over 100 SCI papers, including Nature Materials, Nature Communications, Science Advances, etc.

Title: Tellurium Semiconductors and Devices

Abstract: Complementary Metal-Oxide-Semiconductor (CMOS) technology is the cornerstone of modern information technology due to its low power consumption and high noise immunity. However, the localized valence bands and self-compensating defects in p-type inorganic semiconductors result in low hole mobility, making it difficult to complement n-type semiconductors. This bottleneck severely restricts the further development of CMOS technology. Tellurium (Te)-based semiconductors, as novel hole-transport materials, are regarded as an ideal material system to break through this technological barrier. This study addresses key scientific and technological challenges in the application of Te-based semiconductors: (1) developing a scalable fabrication process combining multiscale van der Waals epitaxial growth with low-temperature oxygen implantation, successfully achieving high-hole-mobility p-type transistor arrays; (2) revealing the photothermoelectric coupling effect and strain-regulated ferroelectric polarization mechanism in Te-based semiconductors, enabling broadband photodetection and efficient mechanical energy harvesting; (3) by optimizing back-end process compatibility, pioneering the low-power integration of Te-based devices with standard CMOS circuits.

Invited Speaker

17:50-18:10

Zhuo Li

Fudan University

Bio: Zhuo Li is a Professor in the College of Smart Materials and Future Energy, and a PI in the State Key Laboratory of Molecular Engineering of Polymers at Fudan University, where her research focuses on functional polymer composites for flexible sensors and electronic packaging. She earned her B.S. degree from Tongji University, followed by an M.S. from Virginia Tech and a Ph.D. from the Georgia Institute of Technology. Before joining Fudan, Dr. Li worked as a Materials Engineer at Celanese Corp. and CNPC USA Corp. She has published over 90 papers in journals such as Science Translational Medicine, Nature Communications, Advanced Materials. She currently serves as the associate editor for IEEE TCPMT, the chair of the IEEE-EPS Shanghai Chapter, and the IEEE-WIE Shanghai affinity group. Dr. Li was a recipient of the IEEE EPS Outstanding Young Engineer Award in 2020.

Title: Flexible Pressure/strain Sensors and Quantum Tunneling Effect

Abstract: Flexible pressure and strain sensors have attracted wide attention due to their applications in health monitoring, VR/AR devices, sporting equipment, and robotics. Achieving high sensitivity in resistive sensors typically involves two strategies: percolation theory and alterations in contact resistance. However, the quantum tunneling effect of nanomaterials offers a less explored yet promising avenue for enhancing sensitivity.

In this talk, I will introduce four recent studies conducted by our team on quantum tunneling. In our initial study, we utilized vertically aligned carbon nanotubes (VACNTs) as field emitters and a spin-coated polymethyl siloxane (PDMS) layer as both insulator and pressure sensing material. The thinning of the PDMS layer under pressure reduced the tunneling barrier for electrons from VACNTs, resulting in a significant increase in tunneling current. This sensor not only set sensitivity records but also achieved ultrahigh precision. In a subsequent study, we employed spiky hollow carbon nanospheres dispersed in a PDMS matrix, leading to a sensor array with ultrahigh sensitivity and a high sensing density that is six times higher than the human finger. Further research involved organizing these nanospheres into compact films through floating assembly, followed by the creation of dense sensing array using laser ablation. This stretchable strain sensing array exhibit a high gauge factor of 70000 and a sensing density of 100/cm2. Additionally, we will discuss methods to mitigate quantum tunneling in capacitive pressure sensors to improve signal-to-noise ratios.

Technical Sessions

D2-PM-B05: M/NEMS Resonators

16:00-17:50, April 18, 2026 **Meeting Room 302B**

Session Chair: Cheng Tu, University of Electronic Science and Technology of China

Invited Speaker

16:00-16:20 **Xuqian Zheng**

Nanjing University of Posts and Telecommunications

Bio: Xu-Qian Zheng is currently an Associate Professor at College of Integrated Science and Engineering (College of Industry-Education Integration), Nanjing University of Posts and Telecommunications. He received the Ph.D. degree in Electrical Engineering from Case Western Reserve University, USA in 2019. And then he joined University of Florida, USA, as post-doctoral researcher. His major research area is ultra-wide-bandgap materials for MEMS/NEMS applications. He also works on the development of piezoelectric MEMS/NEMS, fundamental study of 2D material NEMS devices, and piezoelectric energy harvesting from ambient vibrations.

Dr. Zheng has published 25 peer-reviewed journal papers and contributed 15 top conference publications. He was the single recipient from Case School of Engineering of the Ruth Barber Moon Award in recognition of his academic promise and leadership at Case Western Reserve University in 2017. He was in the finalists of the Best Student Paper Competition at the 2016 IEEE International Frequency Control Symposium (IFCS 2016) and the Outstanding Paper Award Competition at the 30th IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2017).

Title: Laser Interferometry for NEMS Resonators: Applications and Optimization

Abstract: Nano-electromechanical systems (NEMS) resonators offer exceptional mass sensitivity and high operating frequencies, making them indispensable for advanced sensing and fundamental physics research. However, characterizing their intricate dynamics requires high-precision readout techniques. This talk explores the system of laser interferometry for analyzing NEMS resonator behavior, with thermomechanical, photothermal, and electrostatic actuation methods. We first detail the operational principles of interferometric measurement and its integration with distinct drive mechanisms. Subsequently, we present specific applications, including solar-blind ultraviolet sensing utilizing gallium oxide NEMS via photothermal actuation, and the characterization of nonlinear dynamics under thermomechanical and electrostatic drives. Furthermore, we demonstrate the unique capability of the NEMS platform to determine the mechanical anisotropy of emerging materials. Finally, the presentation addresses the optimization of measurement sensitivity through laser polarization techniques, highlighting pathways to maximize the performance of optical readout systems in NEMS research.

Invited Speaker

16:20-16:40

Nan Wang

Shanghai University

Bio: Nan Wang is currently a Professor in the School of Microelectronics, Shanghai University, China. He received his B.Eng. (Hons.) and Ph.D. degrees in 2009 and 2013, respectively, both from the Department of Electrical and Computer Engineering, National University of Singapore (NUS), Singapore. Prior to joining Shanghai University in Nov 2022, he has been working as a scientist and principal investigator (PI) in the Institute of Microelectronics (IME) of the Agency for Science Technology and Research (A*STAR), Singapore, since 2013, where he was attached during his Ph.D. candidature from 2009 to 2013.

His current research interest focuses on AlN/AlScN based micro-electro-mechanical system (MEMS) resonating devices, including resonators for timing and gas sensing applications, radio frequency (RF) MEMS acoustic filters, as well as their corresponding fabrication process development. Prof. Wang has over 100 international journals and conference publications, and received sereral awards such as the Best Paper Award for the 5th IEEE International Nanoelectronics Conference (INEC) 2013. He also served as TPC member and session chair for TRANSDUCERS 2021 and IEEE NEMS 2018, and referee for several highly-reputable journals (Nature Communications, Advanced Functional Materials, etc.).

Title: High-Q Piezoelectric MEMS Resonators based on Wave-Interference Anchor Loss Reduction

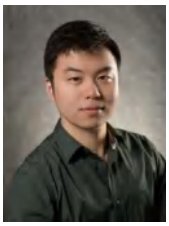
Abstract: Piezoelectric MEMS resonators are widely used in oscillators, filters, and sensors because of their low motional resistance and CMOS compatibility; however, their performance is often limited by a low quality factor (Q), which directly affects frequency stability, insertion loss, and sensing sensitivity. The Q value reflects energy dissipation per cycle arising from multiple mechanisms, including anchor loss, thermoelastic damping, and air damping, among which anchor loss is generally the dominant factor. Anchor loss originates from mechanical waves leaking from the resonant body into the substrate through the anchors. To address this issue, prior studies have focused on confining acoustic energy within the resonator using techniques such as biconvex or butterfly-shaped geometries and phononic crystal anchors that introduce acoustic bandgaps. This work investigates mechanical wave propagation along anchors and proposes a three-cantilever coupled anchor structure to induce destructive interference, thereby significantly reducing anchor loss and enhancing Q.

Invited Speaker

16:40-17:00

Yansong Yang

Hong Kong University of Science and Technology



Bio: Yansong Yang is currently an Assistant Professor in the Department of Electronic and Computer Engineering at The Hong Kong University of Science and Technology, where he founded the Radio Frequency Microsystem (RFMY) Lab. His lab focuses on multi-physics microsystem technologies that integrate electrical, mechanical, and acoustic domains to enable single-chip platforms for signal processing, sensing, and computation, as well as AI-driven design and manufacturing of next-generation ultrasonic and radio-frequency microelectromechanical systems (ultrasonic/RF MEMS).

He has been awarded the 2023 Early Career Award from the IEEE Electron Devices Society (EDS) and the 2025 IEEE Ultrasonics Early Career Investigator Award from the IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society (UFFC). He has received the 2nd Place Best Paper Award at the 2018 IEEE International Microwave Symposium and the Best Paper Award at the 2019 & 2025 IEEE International Ultrasonics Symposium. He was also a finalist for the Best Paper Award at the 2018 IEEE International Frequency Control Symposium and the Advanced Practices Paper Competition Award at the 2020 IEEE International Microwave Symposium. Additionally, he received the 2019 P. D. Coleman Graduate Research Award from the University of Illinois at Urbana-Champaign (UIUC) and the 2022 Microwave Prize from the IEEE Microwave Theory and Techniques Society (MTT-S).

He is currently serving as the Technical Committee Chair for Microelectromechanical Systems in IEEE EDS, a Technical Committee Member for RF MEMS and Microwave Acoustics in IEEE MTT-S, and a Technical Committee Member for the IEEE International Conference on Micro Electro Mechanical Systems. Additionally, he serves as an Editor for IEEE Transactions on Electron Devices and an Associate Editor for IEEE Electron Devices Magazine.

Title: Piezoelectric Acoustic Waves Empower Ultrasonic and RF Applications

Abstract: Piezoelectric acoustic nano/microelectromechanical system (MEMS) devices, driven by the flourishing advancement of micromachining industries, have undergone a significant transformation in functional domains, contributing more physical domains beyond electronics and mechanics. These miniaturized devices create versatile platforms that broaden the acoustic wave spectrum from MHz to mmWave frequencies. The renewed interest in this broad spectrum has spurred the development of innovative techniques, including ultrasonic sensing transducers and ultra-compact radio-frequency spectral processing components, shaped by their architecture and frequency characteristics. The ability of acoustic MEMS devices to launch, manipulate, and utilize acoustic waves has facilitated the transition of scientific concepts into commercial consumer electronics. This talk will introduce a series of acoustic wave platforms based on piezoelectric thin films and unique fabrication technologies to cover an unprecedentedly wide frequency range with more efficient transduction.

Keynote Speaker

17:00-17:30 **Chengjie Zuo**

University of Science and Technology of China

Bio: Chengjie Zuo

Title: Next-Generation RF Filter Technologies for 6G and Wi-Fi 8

Abstract: This talk will first give an overview on advanced chip-level RF filter technologies that have been developed and commercialized during the deployment of 3G, 4G and 5G wireless communications. These include the conventional SAW, BAW/FBAR, LTCC filters, as well as the emerging IHP-SAW, XBAR and Hybrid technologies. To further enhance filter performance for 6G and Wi-Fi 8 applications, two directions of research have been pursued on next-generation acoustic resonators at the SRS lab of USTC. Lamb wave resonators based on suspended LiNbO3 thin film have been extensively studied to push the operating frequency up to mmWave bands with high performance. On the other hand, a bunch of new SAW modes (including CS-SAW, LS-SAW, and SV-SAW) have been proposed and implemented for the first time to achieve unprecedentedly high electromechanical coupling coefficient (k2 > 42%) at cmWave frequencies.

Invited Speaker

17:30-17:50 **Pengcheng Xu**

State Key Lab of Transducer Technology, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences

Bio: Pengcheng Xu is currently a professor and doctoral supervisor at the Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences. He earned his Ph.D. in Microelectronics and Solid-State Electronics from the University of Chinese Academy of Sciences. He is a Technical Program Committee (TPC) member for the Transducers Conference in 2023 and 2025. Additionally, he serves on the Technical Committee of Gas and Humidity Sensors of the Chinese Institute of Electronics and is a member of the Micro-Nano Devices and Systems Technology Branch of the Chinese Instrument Society. Professor Xu's research focuses on micro-nano sensing technology, including the design of new MEMS sensors, the development of nano-sensors, microsystem integration, and innovation in scientific instruments for material characterization. Many MEMS chips he has led in development have been successfully industrialized in areas such as environmental monitoring and industrial testing, and he has played a key role in formulating a national standard. In terms of academic accomplishments, Professor Xu has published over 210 papers in top journals like Nano

Letters, Analytical Chemistry, Small, Sensors and Actuators B, as well as at top conferences such as IEEE MEMS and Transducers. His work has garnered more than 6,300 citations, and his H-index has reached 44 (Google Scholar). More than 50 invention patents have been granted in technological innovation. These patents cover processes for preparing MEMS devices, key technologies for scientific instruments, and various other areas. In 2023, he won the first prize at the Shanghai Technological Invention Award for his achievements.

Title: Advances in Next-Generation MEMS-Based Material Characterization Instruments

Abstract: Gas-solid interfaces are fundamental to catalysis, adsorption, and gas sensing mechanisms. By exploring their structural features and surface activities, we can gain a deeper understanding of the underlying reaction mechanisms and kinetics. However, traditional studies of interfacial properties rely heavily on ex situ characterization, which limits the ability to monitor material evolution in real time under working conditions. To overcome these limitations, our team has recently developed a suite of in-situ characterization methods based on microelectromechanical systems (MEMS). Specifically, we have developed in-situ transmission electron microscopy (TEM) chips and highly sensitive, resonant cantilever-based in-situ instruments. Ultimately, our work provides innovative perspectives and robust technical support to elucidate gas-solid reaction kinetics and optimize functional nanomaterials.

Technical Sessions

D2-PM-B06: Micro-Nano Chemical Sensor

16:00-17:50, April 18, 2026 **Meeting Room 305**

Session Chair: Cui Ye, Shanghai Jiao Tong University

Keynote Speaker

16:00-16:30 **Jian Chen**

Aerospace Information Research Institute, Chinese Academy of Sciences

Bio: Jian Chen

Research Professor, Aerospace Information Research Institute, Chinese Academy of Sciences (CAS)

Deputy Director, State Key Laboratory of Sensor Technology

Honors and Appointments:

National "Ten Thousand Talents Program" Leading Scientist (Ministry of Science and Technology)

National Science Fund for Distinguished Young Scholars

Core Member, National Science Fund for Creative Research Groups

Outstanding Member, Youth Innovation Promotion Association, CAS

Beijing Science and Technology Rising Star

Chief Scientist, National Key R&D Program

Education and Career:

Dr. Chen received his Ph.D. in 2011 from the University of Toronto, Canada (Advisor: Academician Yu Sun). He joined the Chinese Academy of Sciences the same year. His research focuses on fundamental studies for high-throughput single-cell detection applications.

Research Achievements:

Dr. Chen has led landmark projects including Key Programs of the National Natural Science Foundation of China and National Key R&D Program projects. He has overcome technical bottlenecks in micro/nanodevice fabrication, rapid quantitative parameter measurement, and characteristic spectrum construction for high-throughput single-cell detection. Building upon original MEMS compression channel sensing principles, he proposed new dimensions for high-throughput single-cell detection and developed a series of new instruments. These technologies have been demonstrated and applied at over ten institutions including Capital Medical University and Peking University. He pioneered the establishment of quantitative classification and typing systems for whole blood analysis and leukemia diagnosis, significantly advancing technological progress in

hematology analysis and leukemia diagnosis.

Awards:

Second Prize, Technical Invention Award, China Instrument and Control Society (2020)

Second Prize, Natural Science Award, Beijing Municipality (2023)

Publications and Patents:

Dr. Chen has published nearly 160 SCI papers in journals and over 120 papers in international conferences within his field. He has authored one English monograph and applied for nearly 60 Chinese invention patents, with nearly 50 granted.

Professional Service:

Dr. Chen holds positions in multiple academic and social organizations, including the Chinese Society of Micro-Nano Technology, China Instrument and Control Society, Chinese Society of Biotechnology, Beijing Youth Federation, Chinese Research Hospital Society, and Chinese Information Research Association of Traditional Chinese Medicine.

Title: High-Throughput Single-Cell Detection Methods and Quantitative Flow Cytometry

Abstract: Single-cell detection serves as a critical analytical tool for cell biology research addressing frontier scientific challenges such as tumor heterogeneity, with over 150 papers published in Cell, Nature, and Science (CNS) in the past five years. In precision medicine for human health, single-cell detection provides essential diagnostic methodologies and plays a central role in whole blood analysis and leukemia diagnosis.

However, the field currently faces a significant technical bottleneck: the inability to rapidly quantify and detect single-cell physicochemical characteristics. The key scientific challenge lies in the unclear quantitative relationship between single-cell physicochemical characteristics and cell classification/typing, which severely constrains advances in oncology and hematology.

To address this challenge, the speaker has dedicated over a decade of research to elucidate the high-throughput quantitative principles for detecting single-cell electrical, mechanical, and protein expression characteristics based on MEMS "compression channel" technology. This work has led to the development of corresponding quantitative flow cytometry instruments and revealed the quantitative relationships between single-cell electrical, mechanical, and protein expression characteristics and the classification of peripheral blood leukocytes as well as the typing of acute leukemia.

These research achievements have been recognized with prestigious awards including the Beijing Municipal Natural Science Award and the Technical Invention Award from the China Instrument and Control Society.

Invited Speaker

16:30-16:50

Songsong Tang

University of Science and Technology of China

Bio: Dr. Songsong Tang is a Professor in the Department of Biomedical Engineering at University of Science and Technology of China (USTC). He received his PhD training in Chemistry and Bioengineering at University of Science and Technology Beijing (USTB) and in Chemical and Nanoengineering at University of California, San Diego (UCSD). He then conducted postdoctoral research in Prof. Wei Gao's group in the Department of Medical Engineering at California Institute of Technology (Caltech). His research focuses on the design of biohybrid micro/nanorobots that bridge synthetic miniaturized machines with biological world for precision therapy. By integrating living and biomolecular components, such as cells, bacteria, vesicles, and proteins, with diverse power modalities and functional modules, he has developed biocompatible, biodegradable micro/nanorobots capable of various biological functions, precise navigation, sensing and therapeutic actions within complex physiological environments. His work has been published as first or corresponding author in journals such as Nature Nanotechnology, Science Robotics, Science Advances, PNAS, and Advanced Materials. He aims to create next-generation micro/nanorobotic platforms with converged capabilities to advance therapeutic interventions and maximize clinical outcomes.

Title: Biohybrid Micro/nanorobots for Precision Therapy

Abstract: Micro/nanorobots are miniaturized machines that convert environmental energy (chemical, light, ultrasound, electric, or magnetic) into propulsion, enabling active motion and opening new opportunities for medical interventions and micro–nano chemical sensing. Yet most systems still lack key features for practical use, including biocompatibility, biodegradability, precise control, selective chemical recognition, and robust signal readout in complex biofluids and tissues. Here, we convert biological building blocks—living cells, bacteria, vesicles, and proteins—into autonomous machines by immobilizing biocatalytic or magnetic engines on their surfaces, while preserving their native biofunctions. The resulting biohybrid micro/nanorobots are inherently biocompatible and biodegradable, and can be modularly integrated with chemical sensor interfaces and reporters for motion-enabled in situ detection. These platforms actively sample local microenvironments, support imaging-guided navigation, enhance tissue binding/penetration, and enable targeted payload delivery. Collectively, this work establishes a "sense–navigate–act" paradigm toward clinically translatable micro–nano robotic tools for precision therapy and chemical sensing.

Invited Speaker

16:50-17:10 **Lan Yin**

Tsinghua University

Bio: Dr. Yin is an Associate Professor in School of Materials Science and Engineering at Tsinghua University. She received her Bachelor ' s degree in Materials Science and Engineering from Tsinghua University and her and Ph.D. degree Materials Science and Engineering from Carnegie Mellon University. Her research interests are focused on biodegradable materials and bioelectronics. She is the author of over 50 journal papers and 3 book chapters. She received Excellent Young Scholar Award from the National Natural Science Foundation of China (NSFC) in 2021, and is honored with the Chinese Materials Research Society (CMRS) the first prize of Science and Technology Award (2021) and MRS Communications early career distinguished presenter (2025).

Title: Biodegradable Materials for Neural Interfaces and Biosensors

Abstract: Biodegradable materials, capable of degrading naturally under physiological conditions, offer significant advantages by eliminating the need for surgical removal and minimizing infection risk. These properties unlock new possibilities for applications in neural modulation, regenerative medicine, and biosensing, with profound implications for therapy and diagnosis. Here, we report the development of a biodegradable, flexible optoelectronic device for neural stimulation. Using transdermal optoelectronic stimulation, this device enabled functional recovery of injured facial nerves in New Zealand rabbits. Additionally, we introduce a biodegradable and restorative neural interface for wireless, real-time monitoring and repair of long-gap nerve injuries. By integrating machine learning algorithms, the platform continuously tracks nerve recovery, detects early-stage neuroma formation, and facilitates timely therapeutic interventions. These advances highlight innovative strategies for probing and modulating neural activity, offering great potential for next-generation biomedical devices.

Invited Speaker

17:10-17:30 **Ye Tian**

Northeastern University

Bio: Dr. Ye Tian is a Distinguished Research Fellow at the College of Medicine and Biological Information Engineering, Northeastern University, and serves as a doctoral and master' s supervisor. He is also recognized as an Outstanding Talent of Shenyang.

Dr. Tian has published over 60 papers in prestigious journals such as Nature Communications, Nano-Micro Letters, and Advanced Functional Materials, including 6 ESI Highly Cited Papers, 2 ESI Hot Papers, and 4 cover articles. His work has been highlighted and cited by top journals including Nature and Nature Chemical Engineering, and featured by media outlets such as the South China Morning Post, Sputnik, and MIT Technology Review.

He has led or contributed to 17 research projects at various levels, including the National

Key R&D Program of China, and has received more than 20 awards and honors, including the First Prize of the Liaoning Provincial Science and Technology Progress Award and the Young Scholar Award in Microfluidics. He also serves in 14 academic positions, including Associate Editor of Engineering Reports. Dr. Tian holds 1 international PCT patent and 12 domestic patents/software copyrights, and has achieved RMB 10 million in technology commercialization as project leader.

Title: Hydrogel Flexible Sensing

Abstract: Hydrogel materials have attracted much attention due to their excellent properties. However, hydrogel materials have problems such as easy leakage of conductive ions, easy water loss/susceptibility to environmental influence, and difficulty in coexistence of sensing and actuation, which greatly limit their application. We have respectively adopted the superheterostructure strategy, ion interlock coupling method and heterogeneous gradient method to overcome the shortcomings of the above-mentioned hydrogels, achieving a hydrogel flexible sensing technology with long-lasting conductivity, environmental adaptability and coexistence of sensing and actuating. The hydrogel sensor we developed features ultra-high conductivity, ultra-high sensitivity and ultra-fast actuation speed, laying a solid foundation for the practical application of hydrogel sensing. By integrating software and hardware technologies, artificial intelligence technologies, wireless transmission technologies, etc., we have successfully applied hydrogel flexible sensing technology in fields such as rehabilitation medicine, sports monitoring, human-computer interaction, electronic skin, air water collection, and wound dressings.

Invited Speaker

17:30-17:50

Ting Wang

Nanjing University of Post and Telecommunications

Bio: Ting Wang is a professor of Nanjing University of Posts and Telecommunications (NJUPT), China. She received her Ph.D. degree from Central South University in 2015. From 2015 to 2021, She was a postdoctoral fellow at the School of Materials Science and Engineering, Nanyang Technological University (Singapore). She joined NJUPT as a professor in June 2021. Her research interests focus on developing biosensors on soft interfaces for non/minimal-invasive health monitoring and artificial system. She has published more than 20 papers as the first/corresponding author including Nature Electronics, Nature Communications and Advanced Materials. She also been sponsored by fundings such as the Natural Science Foundation for Excellent Young Scholars (2023), the Program of Jiangsu Specially-Appointed Professor (2022), etc. She is selected as MINE Young Scientist (2023), Nanoscale Emerging Investigators (2022) and invited as a guest editor of Biosensors to organize a special issue of Flexible biosensors.

Title: Perception of Biomolecules on Soft Interfaces

Abstract: Monitoring wound protein biomarkers, especially inflammation-related proteins, is essential to assess wound progression and guide treatment. However, high-fidelity wound biosensing is challenging because of current biosensors' limitations in detecting low-abundance proteins and their vulnerabilities to

mechanical deformation, biofouling, and performance degradation. Here, we introduce a soft bioelectronics embedded with Self-Confined Tetrahedral DNA circuit (SCTD) for wound monitoring. In SCTD, proteins in wound exudate trigger DNA self-circulation amplification confined in the hydrophilic area, decreasing detection limits by an order of magnitude. The tetrahedral DNA structure ensures excellent mechanical stability (within 3% variation after 1000 bending cycles), prolonged stability (within 8% signal attenuation over 4 weeks), and reduced biofouling (over 50% BSA adhesion reduction). Coupled with wireless readout, this platform simultaneously monitors multiple wound-related proteins (TNF-α, IL-6, TGF-β1, and VEGF) and biophysical parameters. The wireless platform demonstrates accurate in-situ monitoring of both non-infected and infected wounds on diabetic male mice without hindering the healing process, offering quantitative and comprehensive evaluation to guide treatment.

Technical Sessions

D2-PM-B07: Piezoelectric and Acoustic MEMS

16:00-17:20, April 18, 2026 **Meeting Room 306**

Session Chair: Bowen Sheng, Peking University

Invited Speaker

16:00-16:20 **Xin Lan**

Harbin Institute of Technology

Bio: Prof. Xin LAN received his B.S. degree (2005) and Ph.D. degree (2010) from the School of Astronautics at Harbin Institute of Technology (HIT) China, and researched as visiting scholar in Nanyang Technological University (2007) and Harvard University (2010). He is currently a full professor in HIT, and works in the Center of Smart Materials and Structures directed by Prof. Jinsong Leng. His research focuses on the mechanics of smart material structures, vibration dynamics, and active vibration control based on smart materials, including active vibration reduction and noise control with piezoelectric materials, mechanical metamaterials for noise control. He has published over 60 papers, which were cited more than 2,000 times.

Title: Active Vibration Control Technology for High-Stiffness Structures Using High-Voltage Piezoelectric Drive

Abstract: Aiming at the vibration problem of high-stiffness structures, a self-developed 1000V high-voltage stacked piezoelectric actuator was employed for active vibration control. The actuator exhibits characteristics such as high static load capacity (ton-grade), high static stiffness (on the order of 10^8 N/m), large driving force (measured output driving force of 6000 – 10000N), and high input/output linearity (nonlinearity <1%). Centered on the force-electric coupling characteristics of piezoelectric ceramic actuators, research was conducted on the active control mechanism for vibrations in high-degree-of-freedom elastic structures. An adaptive active control algorithm achieved efficient suppression of multiple line spectra and narrowband spectra. Furthermore, an ultra-low-latency hardware and software system for piezoelectric-driven active vibration control was independently developed, and key functional verifications were completed on multiple high-stiffness structural test specimens.

Invited Speaker

16:20-16:40

Yu Du

Dalian Maritime University

Bio: Du Yu obtained his doctoral degree from Shanghai Jiao Tong University in 2023 and joined Dalian Maritime University as a lecturer in the same year. He is a high-level talent (young elite) introduced by Dalian City. Dr. Du has long been engaged in research in the field of energy harvesting and self-powered sensing. He has published more than ten SCI-indexed papers in top-tier/authoritative international journals, including Nature Communications (IF: 15.7), Small (IF: 13.0), Energy Conversion and Management (IF: 11.533) and Nano Energy (IF: 17.881). He was awarded the Ye Shenghua Scholarship in 2019 and 2023 by the Teaching Guidance Committee for Instrumentation Majors of Institutions of Higher Education under the Ministry of Education of the People's Republic of China (only 10 recipients are selected nationwide each year). He also received the National Excellent Doctoral Dissertation Award in the Field of Measurement, Control and Instrumentation in 2025, which is conferred by the China Instrument and Control Society (only 6 doctoral dissertations were granted this award nationwide in the corresponding year). In addition, he presides over one Youth Science Fund Project of the National Natural Science Foundation of China and one General Program of the China Postdoctoral Science Foundation.

Title: Mechanical Self-Adaptive Porous Valve Relying on Surface Tension for Energy Harvesting from Low-Flux Bubbles

Abstract: Harvesting energy from subsea bubbles, such as those produced by photosynthesis of benthic plants or submarine methane seepage, is a promising solution for powering subsea environment perception devices, but the low gas flux brings significant challenges. Herein, we propose a passive mechanical self-adaptive porous valve with self-adaptive mechanical properties and high gas permeability. It improves energy harvesting performance from low-flux bubbles by controlling bubble accumulation and high-speed release. Unlike traditional active mechanical metamaterials, this passive design utilizes gas-liquid interface deformation (rather than metamaterial actuation) to generate self-adaptive Laplace pressure counteracting bubble buoyancy, and thus requires no external energy. The porous valve has a stable opening threshold inversely proportional to its structural pore diameter. Compared with a bubble energy harvesting device with no valve, the instantaneous gas-intake rate of the device equipped with the porous valve is increased by one to four orders of magnitude, and the maximum output power and electrical energy production are enhanced by factors of 36.6 and 16.4, respectively. The energy of underwater biological metabolic gas with a low flux (28 μL • min-1) is effectively harvested and supplied to an underwater sensor. This work is expected to provide in situ energy for subsea self-powered sensing and autonomous exploration.

Invited Speaker

16:40-17:00

Andrea Vergara

Tohoku University

Bio: Andrea Vergara received her B.E. degree in Mechanical Engineering from the University of Chile in 2015 and her Dr. Eng. degree from Tohoku University in 2021. During her doctoral studies, she spent six months as an exchange researcher at the Department of Power Mechanical Engineering, National Tsing Hua University in Taiwan. Since October 2021, she has been an Assistant Professor at Tohoku University, where she also joined the Global Promotion Office of the Mechanical and Aerospace Engineering Division in 2025.

Her work focuses on developing piezoelectric MEMS devices and materials, with an emphasis on combining thin-film piezoelectric technology with microfabrication for practical microsystems. She received the Best Oral Presentation Award at IEEE MEMS 2022, contributed an invited paper to the Journal of Micromechanics and Microengineering Emerging Leaders 2023 special issue, and was honored with the Young Researcher's Encouragement Award at the 42nd Sensor Symposium by the Institute of Electrical Engineers of Japan. In 2025, she also served on the Technical Program Committee for Transducers 2025 in Orlando, USA.

She is a member of IEEE, JSME, and IEEJ, and enjoys working at the interface of materials, devices, and system integration for next-generation piezoelectric MEMS.

Title: Piezoelectric MEMS Technology at Tohoku University: From Traditional to Emerging Applications

Abstract: Piezoelectric MEMS (PiezoMEMS) technology has become a key platform for miniaturized sensors and actuators in next-generation acoustic, optical, and haptic systems. At Tohoku University, our laboratory has pursued an integrated approach spanning material development, device engineering, and system-level applications. This talk introduces our recent progress in piezoelectric thin-film materials, MEMS device architectures, and emerging microsystem applications for acoustic and optical functionalities.

We first present advances in high-performance piezoelectric materials, including single-crystal-oriented sputtered PZT thin films and epitaxial Sm-doped PMN-PT thin films, which enable large electromechanical coupling and improved reliability for MEMS integration. Building on these materials, we develop a wide range of piezoelectric sensors and actuators, such as multilayer piezoelectric stacks, piezoelectric micromachined ultrasonic transducers (pMUTs), $LiNbO_3$ /$LiTaO_3$ -based acoustic wave devices, and MEMS micromirrors.

We then highlight emerging applications enabled by these devices, including varifocal liquid lenses and micromirrors with integrated sensing for augmented-reality (AR) glasses, microspeakers for true wireless stereo (TWS) earphones, and pMUT-based ultrasonic actuators for mid-air haptics, active cooling, and compact acoustic sources. Finally, the talk introduces recent efforts toward combining actuation and sensing within piezoelectric MEMS to improve performance, reliability, and system integration for future wearable and human–machine interface technologies.

Invited Speaker

17:00-17:20

Jianwei Zhong

South China University of Technology

Bio: Dr. Jianwei Zhong is an Associate Professor at the School of Microelectronics, South China University of Technology. His research focuses on intelligent lab-on-chip systems, micro/nano sensors, and MEMS technologies for single-cell analysis, biointegration, and precision diagnostics. He has established a distinctive research program in sensing-and-control integrated chips for high-throughput biological analysis, with contributions in megahertz electric-field sensing, electro-acoustic microfluidic systems, and label-free single-cell analysis. His work bridges fundamental sensing mechanisms and translational biomedical applications. In the past five years, Dr. Zhong has published 22 papers, including 15 as first or corresponding author, in high-impact journals including Nano Letters, Biosensors and Bioelectronics, Small Methods, Small, Lab on a Chip, and Sensors and Actuators B: Chemical. He has also filed multiple patents in PCT, the United States, China, and Hong Kong. He received the 2024 National Outstanding Self-Financed Chinese Students Abroad Scholarship. His current work expands toward terahertz metasurface biosensing and high-sensitivity biomolecular detection.

Title: BioMEMS for Single-cell Sensing and Sorting Integration

Abstract: This talk presents an integrated microfluidic platform for label-free single-cell sorting based on the synergy of megahertz electrical sensing and surface acoustic wave actuation. Unlike passive encapsulation approaches, the proposed system enables active, real-time discrimination and sorting of empty droplets, single-cell droplets, and multicell droplets. By combining quantitative electrical characterization with closed-loop electro-acoustic control, the platform achieves high-throughput and high-purity cell sorting, exceeding 200 droplets per second with approximately 90% purity. The work highlights a scalable route toward intelligent cell sorting systems for single-cell sequencing and translational biomedical applications.

Technical Sessions

D2-PM-B08: Micro/Nanomechanical Inertial Sensors

16:00-17:50, April 18, 2026 **Meeting Room 307**

Session Chair: Chengxin Li, KU Leuven

Keynote Speaker

16:00-16:30

Huafeng Liu

Huazhong University of Science and Technology

Bio: Dr. Liu Huafeng is currently a Full Professor of MEMS with the National Gravitation Laboratory, Huazhong University of Science and Technology. His major research interests include high-precision MEMS inertial sensors and gravity instruments for earth science and space applications. He is also a member of the Board of Directors of China Inertial Technology Society and the Geological Instrument Branch of China Instrumentation Society, and serves as the editorial board member of journals such as Microsys. & Nanoeng. He has published more than 100 SCI/EI papers, authorized more than 20 patents, and won the International Young Scientist Award of Microsystems and Nanoengineering. Currently, he serves as the deputy chief designer of the lunar seismometer for the scientific payloads of the fourth phase of China's Lunar Exploration Program, namely the Chang'E-7 and Chang'E-8 missions, and is responsible for the development of the MEMS lunar seismometer.

Title: Nano-G Level Ultra-Sensitive MEMS Accelerometers and Their Applications

Abstract: MEMS accelerometers have been widely used in consumer electronics, automotive, industrial, medical, defense and other fields. However, due to their low sensitivity, they are generally difficult to meet the needs of high-end applications. However, in recent years, with the breakthrough of related technologies, it is possible to apply them in geophysics and deep space exploration. The speaker will introduce the research progress of his team in Nano-g level high-performance MEMS accelerometers and genetic algorithm to improve the performance, focusing on the progress of MEMS seismometer and MEMS gravimeter, as well as the applications in Mars quake measurement, space microgravity measurement and Moonquake measurement.

Invited Speaker

16:30-16:50

Jianlin Chen

Shanghai University

Bio: Jianlin Chen received the B.Eng. degree in Mechanical engineering from Jilin University, China in 2017, the M.Eng. and Dr.Eng degree in Mechanical engineering from Tohoku University, Japan in 2019 and 2022. Currently he is an associate professor in the School of Microelectronics, Shanghai University. His research topics focus on focus on high performance MEMS inertial sensors, highly sensitive coupled sensors and nonlinear dynamic in MEMS resonators.

Title: Boosting Sensitivity in Resonant Sensors via Nonlinear Internal Resonance-Pumped Complementary Fano Resonance

Abstract: In this talk, we present a novel sensing mechanism termed Complementary Fano Resonance, which is systematically excited through a 1:2 nonlinear internal resonance (IR) energy pumping scheme. Our theoretical and experimental results demonstrate that the complementary Fano resonance shifts the detection metric from a standard "Peak-to-Peak" ratio to a high-contrast "Peak-to-Dip" ratio. Due to the small amplitude at the anti-resonance state (Dip), the sensitivity is enhanced by over one order of magnitude compared to traditional mode-localized sensors. This work provides a universal platform for engineering sharp spectral features in nonlinear MEMS, paving the way for a new generation of high-resolution resonant sensors capable of detecting infinitesimal physical perturbations in complex environments.

Invited Speaker

16:50-17:10

Qianbo Lu

Northwestern Polytechnical University

Bio: Lu Qianbo, Full Professor, Ph.D. Supervisor, a National-Level Young Talent, and ranked in the top 2% of scientists worldwide by Elsevier. He is a Ph.D. jointly trained by Zhejiang University and Yale University, and is currently a tenured professor at the Institute of Flexible Electronics, Northwestern Polytechnical University. His primary research focuses on the rational design of micro-optical inertial sensors and intelligent flexible sensing. He has developed μg-level optical accelerometers, ng-level micro-vibrometers, and picometer-level optical displacement sensors, which have been successfully applied in fields such as aviation and weaponry. He has led six national projects and six provincial and ministerial projects and has been selected for the "Postdoctoral Innovative Talents Support Program". The related technologies and achievements have been awarded two first prize and one second prize in the science and technology awards by China Invention Association and Chinese Society of Aeronautics and Astronautics.

Title: Computational Intelligence-Aided Design of Free-Form Sub- μ g MOEMS Accelerometers

Abstract: The micro-optomechanical accelerometer integrates the advantages of precision optical measurement and MEMS, representing a novel form of accelerometer capable of achieving sub- μ g acceleration measurement on a chip. Our team has established a computational intelligence-aided freeform rational design methodology to address the challenges of complex multi-physics coupling mechanisms and the generally inefficient and non-collaborative design tools for micro-optomechanical accelerometers. Our team has designed and fabricated ng-level accelerometers/gravimeters. We have also designed and fabricated picometer-level optical displacement measurement units. Additionally, we have collaborated on the development of optoelectronic accelerometers for inertial navigation, leading domestically in indicators.

Invited Speaker

17:10-17:30

Kunfeng Wang

Aerospace Information Research Institute, Chinese Academy of Sciences

Bio: Kunfeng Wang, Assistant Researcher at the Aerospace Information Research Institute, Chinese Academy of Sciences. He received his Ph.D. from The State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, Chinese Academy of Sciences, under the supervision of Professor Xudong Zou. As a postdoctoral fellow at the University of Southern California funded by the National Institutes of Health (NIH), he worked with Eun Sok Kim Fellow. His primary research focuses on: high-precision resonant accelerometers/tilt sensors, MEMS piezoelectric microphones; Research interests include: Micro/nano-scale sensor development, MEMS fabrication technologies, Piezoelectric resonators/sensors, Low-noise interface circuit design. He has published over 30 research articles in internationally renowned journals such as Nature Microsystems & Nanoengineering, IEEE Sensors Journal, and IEEE Journal of Microelectromechanical Systems.

Title: Performance Enhancement of DPLL-Based MEMS Resonant Accelerometers by Multi-Resonance Modes Fusion

Abstract: This research presents a novel intra-device fusion strategy for differential MEMS resonant accelerometers (MRAs) that effectively overcomes the fundamental trade-off between measurement bandwidth and noise precision. By leveraging a multi-rate Kalman filter (KF) to asynchronously integrate the outputs of multiple flexural resonance modes within a single device, the proposed method combines a high-bandwidth (200 Hz) configuration for capturing dynamic signals with a low-bandwidth (2 Hz) configuration optimized for noise suppression. Experimental results demonstrate that this approach, further enhanced by high-pass filtering to isolate vibrational acceleration, achieves a significant reduction in noise floor to 85.14 ng/sqrt{Hz} and a bias instability of 20.31 ng while maintaining a full 100 Hz frequency bandwidth. This technique not only improves long-term stability by nearly two orders of magnitude but also enables the high-precision monitoring of ultra-low-frequency environmental

vibrations down to 0.01 Hz, providing a resource-efficient solution for broadband inertial sensing applications.

Invited Speaker

17:30-17:50

Liye Zhao

Southeast University

Bio: Liye Zhao received the Ph.D. degree in instrument science and technology from the School of Instrument Science and Engineering, Southeast University, Nanjing, China, in 2006.

He is currently a Professor with the School of Instrument Science and Engineering, Southeast University. He is also with the Key Laboratory of Micro-Inertial Instruments and Advanced Navigation Technology, Ministry of Education, Nanjing. His research interests include geophysical field-assisted navigation information processing technology, novel sensor designs, and intelligent systems and applications.

Title: High-Fidelity Triboelectric Vibration Sensor Based on the Quasi-Zero Stiffness Characteristic

Abstract: Triboelectric nanogenerator-based vibration sensors present a promising self-powered solution for large-scale, distributed sensor networks. However, driven by a power-centric philosophy, these sensors inherently exhibit a non-uniform frequency response due to resonance mechanisms. This work introduces a quasi-zero stiffness triboelectric vibration sensor engineered with a primary focus on high-fidelity sensing performance. The sensor integrates a quasi-zero stiffness compliant mechanism to strategically shift the fundamental resonance into ultralow frequencies, effectively broadening the flat-response operational bandwidth. Furthermore, the synergistic compensation mechanism significantly minimizes intrinsic measurement errors, while the non-contact triboelectric design avoids mechanical abrasion, guaranteeing sustained high-fidelity performance. Experiments demonstrate that the sensor delivers a nearly constant sensitivity over a wide bandwidth. Notably, it achieves high accuracy in frequency measurement and successfully reconstructs arbitrary, complex vibration waveforms. In addition, a real-time, wireless vibration monitoring platform based on the sensor is developed to demonstrate its practical application in remote vibration analysis. By bridging structural dynamics with self-powered nanogenerator technologies, this work provides a transformative solution for maintenance-free, high-precision condition monitoring within the Industrial Internet of Things (IIoT).

Technical Sessions

D2-PM-B09: Nanodevice Physics

16:00-17:50, April 18, 2026 **Meeting Room 308**

Session Chair: Li Tao, Southeast University

Keynote Speaker

16:00-16:30 **Lei Wang**

Nanjing University

Bio: Dr. Lei Wang is currently a professor in physics department at Nanjing University in China. Previously he was a Kavli fellow at Cornell University. He earned his Doctoral degree at Columbia University and Bachelor degree at National University of Singapore. Dr. Wang has been conducting research on the electrical transport properties of two-dimensional quantum materials, and has made pioneering work on fabrication of high quality 2D material heterostructure devices.

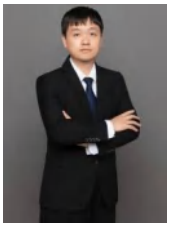
Title: The Development of Atomic-Layer Homo-and Hetero-Nanodevices

Abstract: Precisely controlling the composition and structure of nanoscale building blocks brings us artificial new material systems with completely novel electronic, mechanical, optical properties. Various layered materials such as graphene and TMDs can be primary structures which people have been dreamed to use as single atomic Legos to play with. However, the experimental reality is that these single atomic planes are very fragile and vulnerable to the environment and researchers have been stuck for decades to try to develop a nondestructive assemble method. In this talk, I will review the ‘pick-up transfer’ technique I developed to first make it possible to achieve the layer-by-layer assembling of single atomic planes with ultraclean interfaces. I will show how this technique leads the 2D materials field into the era of high-quality devices and lays the foundation for recent new research domains namely 2D materials heterostructures and moiré systems.

Invited Speaker

16:30-16:50 **Xinghan Cai**

Shanghai Jiao Tong University



Bio: Xinghan Cai, professor at the School of Integrated Circuits, Shanghai Jiao Tong University. He obtained the PhD degree in the Department of Physics, University of Maryland (College Park) in 2015, and then entered the research group of Professor Xiaodong Xu in the Department of Physics, University of Washington (Seattle) as a postdoctoral researcher. He has long been engaged in the research of physical properties of low dimensional quantum systems and the development of optoelectronic and

spintronic devices. His work includes developing sensitive and broadband photodetectors based on novel functional materials (e.g., graphene, violet phosphorus, NbSe2, Nb3I8), elucidating the magnetic structures of various two-dimensional magnetic materials, and fabricating high-magnetoresistance magnetic tunnel junctions via spin-filtering effects. He has published papers in journals such as Science, Nature Nanotechnology, Nature Physics, PNAS and Nano Letters, with a total citation count exceeding 3,000 in the past five years (Google Scholar). Additionally, he serves as a Youth Editorial Board Member for Nano-Micro Letters and a reviewer for top-tier journals including Nature Communications and JACS.

Title: Broadband Photodetection in Graphene-based Two Dimensional Systems

Abstract: This report presents advances in broadband photodetection and optoelectronic applications using graphene-based two-dimensional systems. We first explore a twisted monolayer-bilayer graphene (TMBG) moiré superlattice for ultra-broadband photodetection. By introducing gate-tunable bandgaps, the device achieves exceptional responsivity (16.9 A W−1) and low noise equivalent power (27 fW/Hz1/2) at 0.3 THz, operating from cryogenic to room temperatures. The photoresponse mechanisms are attributed to the photothermoelectric and bolometric effects, demonstrating TMBG as a versatile platform for sensitive sub-terahertz detection. We further demonstrate a reconfigurable TMBG phototransistor for programmable optoelectronic logic. By modulating gate voltages, bias, and magnetic fields, the device dynamically switches among INHIBIT, AND, NOR, and XNOR operations without structural changes. A simulated pixel-wise logic array further validates its applicability to optical computing. In addition, we introduce a wavelength-adaptive synaptic transistor using CrOCl-gated trilayer graphene, enabling spectrally programmable neuromorphic vision. Visible light (532 nm) induces fast potentiation, while near-infrared (912 nm) triggers gradual weight updates, achieving 256 distinct states with long-term retention. A motion extraction algorithm coupled with a convolutional neural network achieves 93% accuracy in speed estimation, highlighting its potential for dynamic visual processing.

Invited Speaker

16:50-17:10

Zaiyao Fei

Nanjing University

Bio: Dr. Zaiyao Fei obtained his Ph.D. in physics from the University of Washington and joined Nanjing Unversity in 2021. His research interests include transport and optoelectronic properties of two-dimensional magnets, ferroelectrics and topological insulators.

Title: Programmable Coercivity and Exchange Bias via Interfacial Spin Reconfiguration in Ferromagnetic Metals

Abstract: Magnetic exchange bias effect in van der Waals heterostructures has attracted growing interest following the discovery of room-temperature van der Waals ferromagnetic metals. However, the evolution of exchange bias with magnetic field in these systems remains poorly understood. Here, we demonstrate a systematic modulation of both the magnetic coercivity and exchange bias in oxidized Fe3GaTe2 thin films,

achieved by tuning the magnetic field sweep range under a symmetric sweep protocol. As the sweep range increases, the coercivity undergoes a pronounced enhancement, while the magnetization reversal remains sharp and the saturated magnetization is unchanged. Meanwhile, a non-monotonic, dome-shaped exchange bias is observed as a function of the sweep range, with its polarity set by the preset antiferromagnetic state of the oxidized layer. These observations can be explained by the field-dependent reconfiguration of interfacial spins, which exchange coupled with the ferromagnetic Fe3GaTe2 and antiferromagnetic oxidized-Fe3GaTe2. Similar behavior is observed in oxidized Fe3GeTe2. These results reveal a field tunable pinning process that enables programmable magnetic properties, establishing oxidized van der Waals ferromagnetic metals as a platform for history-controlled spintronic functionalities.

Invited Speaker

17:10-17:30

Yang Xu

Institute of Physics, Chinese Academy of Sciences

Bio: Yang Xu is an associated professor and PI of N08 Group at the Institute of Physics, Chinese Academy of Sciences (IOP, CAS). He received B.S. from the University of Science and Technology of China in 2011 and Ph.D. from Purdue University in 2018. He then carried out postdoctoral research at Cornell University, and joined the IOP at the end of 2020. His research focuses on device fabrication of low-dimensional quantum materials and their transport and optical properties under extreme conditions, including ultralow temperatures and high magnetic fields, with a recent emphasis on probing and controlling correlated electronic phases in two-dimensional moiré systems. His related work has been published in Science, Nature, and PRL/PRX, etc, and has received over 5,000 citations in total. He has received multiple honors, including "Top 10 Emerging Scientists in China 2023," the 2024 IUPAP Early Career Scientist Prize in Semiconductor Physics, and the 2025 "Rising Star in Science and Technology" Award from IOP, CAS.

Title: Link Between Cascade Phenomenon and Correlated Chern Insulators in Magic-Angle Twisted Bilayer Graphene

Abstract: Magic-angle twisted bilayer graphene (MATBG) is an excellent platform for exploring emergent phenomena arising from topologically nontrivial flat bands at partial fillings. In this talk I will first introduce the research background of MATBG moiré superlattices. I will then present a recently developed Rydberg-exciton sensing technique [1], which exploits the pronounced sensitivity of excited-state excitons in two-dimensional semiconductors to dielectric screening, enabling optical detection of novel quantum states in nearby two-dimensional electron systems. The primary target systems include TMDC moiré superlattices and MATBG. I will discuss that, at zero magnetic field, the high-temperature parent phase of MATBG exhibits a "cascade of phase transitions" (the "cascade phenomenon"), manifested as a series of asymmetric sawtooth features in the electronic compressibility as a function of carrier density. I will show that this behavior can be explained by the widely discussed topological heavy-fermion model for MATBG without invoking any symmetry-breaking state. Furthermore, under out-of-plane magnetic fields, an ordered sequence of correlated Chern insulating states is observed, and a direct link to the zero-field cascade phenomenon is revealed [2].

Invited Speaker

17:30-17:50

Wenjing Zhang

Shenzhen University

Bio: Professor Zhang Wenjing is currently affiliated with Shenzhen University. He earned his Ph.D. in Physical Electronics from the Department of Electronics at Peking University in 2008. Between 2008 and 2014, he engaged in research activities at Nanyang Technological University in Singapore, Academia Sinica in Taiwan, and the National University of Singapore. Professor Zhang's research primarily focuses on the synthesis of wafer-scale single-crystal two-dimensional semiconductor and other novel optoelectronic materials through techniques such as chemical vapor deposition. His work further encompasses the development of innovative functional devices based on low-dimensional materials, including photodetectors, logic operators, flexible electronics, and memristors. To date, he has authored over 100 scholarly articles published in high-impact journals such as Nature Electronics, Nature Materials, and Advanced Materials, accumulating more than 22,000 citations.

Title: High-Performance Photodetectors Based on Band Alignment Engineering of 2D Van Der Waals Heterojunctions

Abstract: Infrared photodetectors are integral to various domains, including remote sensing, thermal imaging, optical communication, and medical diagnostics. The escalating demand for optoelectronic detection technologies has highlighted several challenges faced by conventional infrared photodetectors, such as the complexity inherent in sample synthesis, constraints on device miniaturization and portability due to the necessity for low-temperature cooling systems, and manufacturing difficulties. Two-dimensional (2D) materials, characterized by their distinctive structural features, superior physicochemical properties, and multiple phase configurations, present promising avenues for advancing infrared photodetector technology. This study concentrates on the investigation of novel two-dimensional layered materials optimized for infrared detection applications. By employing band alignment engineering within van der Waals heterojunctions, innovative two-dimensional infrared photodetectors are designed and fabricated. The research examines the photodetection performance and underlying operational mechanisms of these devices, while also exploring strategies to enhance response speed, improve operational efficiency, and broaden the spectral response range of infrared detectors. Ultimately, this work seeks to offer substantive experimental insights to facilitate the development of multifunctional, high-performance two-dimensional infrared photodetector devices.

Technical Sessions

D2-PM-B10: Micro/Nanoelectronic Materials and Devices

16:00-18:20, April 18, 2026 **Convention Hall A**

Session Chair: Yu Zhou, Central South University

Keynote Speaker

16:00-16:30 **Junhao Lin**

Southern University of Science and Technology

Bio: Dr. Junhao Lin obtained his PhD degree in Physics from Vanderbilt University, USA, in 2015. He had his postdoctoral work as a JSPS fellow in AIST, Tsukuba, Japan, from 2015-2018, hosted by Dr. Kazu Suenaga, and continued the research mostly in 2D materials with advanced S/TEM. He joined the Department of Physics, Southern University of Science and Technology (SuSTech) in 2018 as a tenure-track associate professor and was exceptionally promoted to tenured full professor in 2024. His main research direction includes analysis of complex defect structures in novel 2D materials, real-time in-situ observation of the dynamical processes in structural transition of materials under various environmental stimulations, and the development of 2D ferromagnetic and ferroelectric materials. He has published more than 170 journal papers, including a first/corresponding authored paper in Nature (3), Science (1), etc., with a total citation of more than 18000 times, H-index 59 (GoS data).

Title: Atomic Investigation of the Structure-Property Correlation in Emerging 2D Quantum Materials

Abstract: Two-dimensional (2D) materials are considered to be the candidates for future nano-electronic, optoelectronic, and spintronics applications. Understanding the structural origin of the novel physical properties in 2D materials serves as the key step for functionality engineering and improved performance in devices.

In this talk, I will first show the latest development of quantitative intensity analysis techniques in scanning transmission electron microscopy (STEM) imaging, and its applications in revealing the atomic-scale structure-properties correlation in emerging 2D materials. Secondly, I will introduce the universal strategy to overcome the structural degradation problem of air-sensitive 2D materials. We developed a home-built interconnected inert gas protection system compatible with atomic STEM and Cryo-TEM imaging. I will show the recent breakthroughs in the structure-property correlation of various air-sensitive 2D materials. Examples include, but are not limited to: monolayer amorphous carbon where the high-density distorted defect network contributes to its ultrahigh mechanical toughness; intrinsic defect structures in air-sensitive WTe2/MoTe2 monolayer and their heterostructures with enhanced defect states; superlattice reconstruction in 2D ferromagnetic heterostructure with exotic magnetic responses, etc. Lastly, I will talk about the atomic resolution Cryo-HRTEM technique for handling extremely dose-sensitive materials like 2D pervoskites and charge density waves (CDW) in 2D TaS2.

Keynote Speaker

16:30-17:00

Zhongqiang Wang

Northeast Normal University

Bio: Prof. Zhongqiang Wang currently works at the Key Laboratory for UV Light-Emitting Materials and Technology, Ministry of Education, Northeast Normal University. He received his Ph.D. from Northeast Normal University in 2008-2013. He carried out postdoctoral work at the Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano from 2014 to 2016. He has held the topic editor and editorial board member of the journal Frontiers in Neuroscience and Nanomaterials. Member of Chinese Physical Society, the Chinese Institute of Electronics and Institute of Electrical and Electronics Engineers (IEEE).

His research interests are the development of resistive in-memory devices and memristive synaptic devices. He has published more than 40 papers including Nat. Commun., Adv. Mater.. His research papers have been cited more than 1700 by peers in the field (h-index = 21), and the maximum citations of a single article exceed 400. He obtained 10 authorized Chinese/American invention patents and has made more than 20 invitation reports at international conferences, including IEDM. He presided more than 10 key projects from the National Natural Science Foundation of China and Science and Technology Department of Jilin Province. He won National Natural Science Award (second class) in 2019.

Title: Oxide-Based Optoelectronic Memristive Materials and Bionic Vision Devices

Abstract: Optoelectronic memristor integrates the multifunctionalities of image sensing, memory and processing, which has been considered as a promising candidate to develop efficient neuromorphic vision system. The present talk will introduce our recent work on oxide-based optoelectronic memristive materials and neuromorphic devices. The analog complementary memristor based on silver nanowire/sodium alginate film has been developed, which emulates the desensitization behavior and Weber ' s Law in sensory adaptation. Then the image recognition accuracy has been improved by integrating the optical and pressure sensors for multimodal signal processing. The novel plasmonic optoelectronic memristor has been constructed by utilizing Ag-TiO2 nanocomposite film, which enables all-optical modulation of synaptic weights and achieves functional integration of image sensing, storage, and processing. On this basis, the neuromorphic vision system with recognition accuracy of 98% has been demonstrated.

Invited Speaker

17:00-17:20

Shaoying Ke

Minnan Normal University

Bio: Ph.D., Professor, Master's Supervisor, Assistant Dean; Minjiang Scholar Young Scholar, Fujian Province Category C Talent, Longjiang Plan Top Talent, Principal Investigator of a National First-Class Undergraduate Course and a Fujian Provincial First-Class Undergraduate Course, Head of the Microelectronics Science and Engineering program, and Secretary of the Second Teaching Staff Party Branch of the College of Physics and Information Engineering. He has presided over one general project and one youth project funded by the National Natural Science Foundation of China, one Minjiang Scholar Talent Project, two general projects funded by the Fujian Provincial Natural Science Foundation, one project funded by the Zhangzhou Municipal Natural Science Foundation, and six industry-sponsored horizontal projects. His research focuses on silicon-based optoelectronic materials and infrared detectors, avalanche photodetectors, and semiconductor wafer bonding. As first author or corresponding author, he has published over 60 SCI-indexed papers and holds 11 authorized invention patents. Over the past three years, he has supervised eight undergraduate theses recognized as Excellent Graduation Theses, and guided undergraduate students in publishing five SCI papers and ten EI papers. He has received the Third Prize of the 14th Fujian Provincial Excellent Natural Science Academic Paper Award, the title of Outstanding Communist Party Member of Minnan Normal University, and the 2020 Youth May Fourth Medal of Minnan Normal University.

Title: Silicon-Based Heterogeneous Integrated Infrared Detectors

Abstract: Near-infrared detection technology plays an irreplaceable role in applications such as optical communication, quantum communication, and spectral analysis. Although current mainstream III-V and II-VI compound semiconductor infrared detectors exhibit excellent detection performance, their widespread adoption is hindered by high costs and poor compatibility with silicon (Si) fabrication processes. This study proposes and demonstrates a novel integration scheme based on bonding with a semiconductor intermediate layer. By heterogeneously integrating Germanium (Ge) and Indium Gallium Arsenide (InGaAs) thin films onto Si substrates, high-performance Si-based short-wave infrared detectors were successfully fabricated.

The core of this approach lies in using amorphous or polycrystalline semiconductors as the bonding intermediate layer. During low-temperature bonding, this intermediate layer effectively buffers lattice mismatch, blocks dislocations from extending into the active region, and significantly improves the bonding strength at the heterogeneous interface. This results in Ge/Si and InGaAs/Si heterostructures with sharp interfaces and high crystalline quality. Based on these integrated materials, we developed corresponding Ge/Si and InGaAs/Si PIN and APD detectors. The devices demonstrate outstanding performance in terms of sensitivity, operational bandwidth, and gain-bandwidth product, indicating significant potential for advanced applications such as high-speed optical communication and LiDAR. This

bonding strategy offers strong process versatility and can be further extended to the heterogeneous integration of other wide-bandgap semiconductors with silicon platforms, providing a practical and feasible technological pathway for developing low-cost, high-performance silicon-based short-wave infrared detection chips.

Invited Speaker

17:20-17:40

Zegao Wang

Sichuan University

Bio: Zegao Wang was got his PhD degree in 2014, and then work as postdoc/visiting researcher in Denmark, UK and Norway. He was employed as full professor in 2018 at Sichuan University, China. His research mainly focuses on the wafer-scale growth and electronics application of graphene and beyond 2D materials, including gas sensors, photodetectors. Up to now, he has published more than 200 papers including Nature Commun., Science Advances, PNAS, Advanced Materials.

Title: The Growth of 2D Semiconductor and Its Multi-Dimensional Photodetection

Abstract: Compared to traditional refrigerated (such as HgCdTe, InSb) and unrefrigerated infrared detection materials (Si, InGaAs), 2D materials, especially the transition metal dichalcogenides (TMDCs), exhibit rich physical properties due to their atomic-level thickness, high carrier mobility, and extremely easy-to-adjust electronic structure, making it possible to realize the miniaturization, portability, high performance, and low power consumption of infrared detection materials. Based on this topic, our group focus on the growth of these novel 2D materials, including MoS2, PtSe2 and PtS. During the growth, we mainly tune the surface nanostructure, percussor and the setup, and finally realized: 1) 4-inch MoS2 continue film; 2) 2-inch PtSe2. Then, we focus on the electronic/photoelectrical property and their tunability. It was found that the junction promotes the separation of photogenerated electrons and holes due to the formation of a built-in electric field. The photoexcitation originating from the inter-band will extent the photoresponse range from visible to NIR. Some 2D materials such as In2Se3 shows both light-sensitive and polarization-sensitive behavior, facilitating to fabricate multi-dimensional photodetection. Nowadays, MoS2 already realize wafer-scale growth, however its isotropic optical property limited its further application. Regarding this issue, we also studied the modulation such as micro-structure hybridization and bi-layers twisting, which exhibits the potential ability in future multi-dimensional photodetection.

Invited Speaker

17:40-18:00

Hongbing Cai

University of Science and Technology of China

Bio: Prof. Cai Hongbing is from University of Science and Technology of China (USTC), and a PhD supervisor. He earned his PhD in Condensed Matter Physics from USTC in 2013. From 2013 to 2019, he worked as a postdoctoral researcher and Associate Professor at USTC, focusing on low-dimensional nanodevices and micro/nano fabrication. From 2019 to 2024, Prof. Cai conducted research at Nanyang Technological University (NTU) in Singapore, focusing on quantum light sources in two-dimensional materials. In recent years, he has published over 70 papers in top journals such as Nature, Nature Photonics, Nature Electronics, Nature Materials, Nature Communications, Science Advances, Matter, Advanced Materials, Physical Review Letters, and Nano Letters. His work has been cited over 2,500 times, with an H-index of 25.

Title: High Performance 2D Semiconductor Devices by Nanostructures

Abstract: Two-dimensional (2D) semiconductors single photon emitters (SPEs) have great potential in various light quantum technologies owing to their perfect collection efficiency. However, so far, various 2D-semiconductors SPEs are difficult to simultaneously fulfil a combination of high brightness, high stability, and excellent monochromaticity, due to challenges in single-frequency emitting, high intensity, and emitting stability. Here we present a feasible strategy that based on a controllable wrinkling technique, realizes simultaneously high brightness, high stability and excellent monochromaticity in a monolayer WSe2 nano-bulge SPE array with a designable and controllable local uniform large strain gradient. The SPEs exhibit exceptional performance in the SPE generation probability up to about 70% and possess high single-frequency brightness and excellent emitting stability. What’s more, we show that nonradiative decay in 2D WSe2 quantum emitters can be electrically suppressed through charge depletion by utilizing dual gate configurations under a large electric field. In this condition, for site-controlled SPEs in WSe2 coupled to gold nanogaps, the SPE transition quantum efficiency after gating is increased to 76.4 ± 14.6% on average, with some SPEs reaching near-unity (more than 90%) quantum efficiency. Our innovative method represents a powerful generation and modulation method of SPEs in two-dimensional materials.

Invited Speaker

18:00-18:20

Guangdong Zhou

Southwest University

Bio: Guangdong Zhou is currently a professor at theCollege of Artificial Intelligence of Southwest University, a doctoral supervisor, and a talent in the "Chongqing Talent Program". His main research field is intelligent information materials and devices. He has been dedicated to understanding the principles of new optoelectronic memory devices, designing and implementing nanodevices with unprecedented performance, and has

achieved key technological results in dynamic information processing and large-scale array integration. He has developed an all-optical artificial visual system, achieving new functions such as encoding, encryption, and real-time information processing of dynamic visual information. He has been the principal investigator of several projects including national defense key projects, joint projects of natural science funds, and chip technology transformation, with a cumulative budget of over 8 million yuan. He has published over 100 SCI papers (first author/co-author), with 50 of them being SCI-indexed, receiving over 7,000 citations, and an H-factor of 46. He has been granted 4 patents. He has long served as a reviewer for journals such as Nature, Nature Electronics, and Nature Communications. He has won the second prize of the Sichuan-Chongqing Academic Paper Award (ranked first), the third prize of the Guizhou Natural Science Award (ranked second), and the third prize of the Top Ten Scientific and Technological Achievements of the Western Science City in 2024 (ranked Second).

Title: Negative Resistance Effect-Based Photoelectronic Devices for Dynamic Vision Information Processing

Abstract: The negative resistance effect (such as negative photoconductivity effect, negative differential resistance effect) is of crucial importance for neuromorphic computing. This negative resistance property endows the devices with rich nonlinear dynamic characteristics and low-power programming capabilities. This report presents the preparation of negative resistance effect-based devices and their physical mechanisms, and provides a detailed account of the design principles, working mechanisms, integration processes, and advanced computing systems of these devices. It also demonstrates the application of this negative resistance effect in information encryption and real-time processing of dynamic information.

Technical Sessions

D2-PM-B11: Award Finalist Session: Best Conference Paper

16:00-18:00, April 18, 2026 **Convention Hall F**

Session Chair: Xi Xie, Sun Yat-sen University

16:00-16:15	**Paper ID:** Oral# 63 **Paper Title:** Flexible Piezoresistive Sensors Based on Multi-Layer Nanocomposite with Hierarchical Microhemispheres **Presenter:** Xiangmeng Li, North University of China
16:15-16:30	**Paper ID:** Oral# 106 **Paper Title:** All-Printed Hierarchical Flexible Strain – Humidity Dual-modal Sensor for Wound Microenvironment Monitoring **Presenter:** Xianruo Du, Xiamen University
16:30-16:45	**Paper ID:** Oral# 111 **Paper Title:** A Frequency-Tunable LC Resonant Wireless Passive Temperature Sensor **Presenter:** Junyang Li, Ocean University of China
16:45-17:00	**Paper ID:** Oral# 143 **Paper Title:** Gas-Leakage Detection Using Thin-Film Lithium Niobate pMUTs with an Optimized Acoustic Channel **Presenter:** Jiayi Liu, Yongjiang Laboratory
17:00-17:15	**Paper ID:** Oral# 175 **Paper Title:** A Miniaturized Self-Focusing Flexible Ultrasonic Patch for Synchronous Real-Time Gesture Recognition and Force Monitoring **Presenter:** Ziwen Tang, Zhejiang University
17:15-17:30	**Paper ID:** Oral# 243 **Paper Title:** A Novel Capacitive Tactile Sensor with Encapsulated Liquid Metal as Floating Electrode for High Linearity and Reliability **Presenter:** Muhammad Anees Ijaz, Beihang University
17:30-17:45	**Paper ID:** Oral# 293 **Paper Title:** A Lithography-Free Calorimetric Microflow Sensor with Back-Side Integrated Bi2Te3 Thermopile **Presenter:** Yang Liu, Beijing Institute of Technology
17:45-18:00	**Paper ID:** Oral# 302 **Paper Title:** Modelling Nonlinear Coefficients in Frequency Combs Based on Coupled Resonators and Parametric Excitation **Presenter:** Teng Zhang, University of Cambridge

Technical Sessions

D2-PM-B12: Advanced Optical Nanometrology and Nanoscopy

16:00-17:40, April 18, 2026 **Convention Hall C**

Session Chair: Yongliang Yang, Shenyang Institute of Automation, CAS

Keynote Speaker

16:00-16:30

Chao Zuo

Nanjing University of Science and Technology

Bio: Dr. Chao Zuo is a Zijin Chair Professor at Nanjing University of Science and Technology (NJUST), Distinguished Professor of "Changjiang Scholars Program", Ministry of Education of China. He leads the Smart Computational Imaging Laboratory (SCILab: www.scilaboratory.com) at the School of Electronic and Optical Engineering, NJUST, and is also the founder and director of the Smart Computational Imaging Research Institute of NJUST. He has long been engaged in the development of novel Computational Optical Imaging and Measurement technologies, with a focus on Phase Measuring Imaging Metrology. He has published > 300 peer-reviewed articles with over 18,000 citations. These researches have been featured on journal cover (including Light, Optica, LPR, PhotoniX, AP, etc.) over 40 times. He currently serves as an Associate Editor of eLight, PhotoniX, OL, OLEN, and IEEE TCI. He is a Fellow of SPIE | Optica | IOP, and listed as a Clarivate Highly Cited Researcher.

Title: Computational Phase Imaging for Label-Free 3D Microscopy：Noninterferometic Phase Retrieval and Intensity Diffraction Tomography

Abstract: Nowadays, fluorescence microscopy has made the leap from 2D to 3D or even 4D (xyz+t) imaging. On the other hand, Zernike phase contrast microscopy, which was awarded the Nobel Prize in Physics in 1953, has become the standard feature for modern biological microscopy, but is still limited to 2D imaging. Currently, life science research urgently needs a new "label-free 3D microscopy" mode that complements confocal/two-photon/super-resolution 3D fluorescence microscopy technology to meet the needs of rapid, high-resolution, long-term imaging of live cells in 3D. In this talk, we will present some of our research progress in "noninterferometric" intensity diffraction tomography, including: quantitative phase imaging and diffraction tomography based on transport of intensity and Fourier ptychography. Our results highlight a new era in which strict coherence and interferometry are no longer prerequisites for quantitative phase imaging and diffraction tomography, paving the way toward new generation label-free three-dimensional microscopy, with applications in all branches of biomedicine.

Keynote Speaker

16:30-17:00

Peng Xi

Peking University

Bio: Dr. Peng Xi is a Boya distinguished professor at College of Future Technology, Peking University, China. His research interest is on the development of optical super-resolution microscopy techniques. He is a Fellow of OPTICA and IAAM. He has been awarded the National Distinguished Young Scholar. He is the Chief scientist of the Key Research and Development Plan of the Ministry of Science and Technology. He is on the editorial board of 5 SCI-indexed journals such as Light and Advanced Photonics. He has published over 120 scientific journal papers on peer-reviewed journals including Nature, Nature Photonics, Nature Methods, etc., with more than 9,000 citations. He has been granted 3 American patents and over 20 Chinese patents, and delivered many plenary talks on international conferences hosted by SPIE and OPTICA.

Title: Super-Resolution Structured Illumination Microscopy: Polarization, Anisotropy, and Lattice

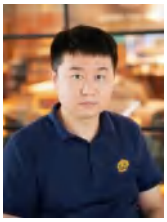
Abstract: This report presents two recent research advances from our work: I) Utilizing polarization-structured illumination microscopy (Polar-SIM) technology, we can extract information on the molecular arrangement within organelles, such as actin-myosin dynamic interactions and the spatial organization between actin and spectrin in neuronal axons. Furthermore, we developed fluorescence anisotropy SIM (FA-SIM), which significantly enhances the spatiotemporal resolution of fluorescence anisotropy (FA) measurements. Live-cell dynamic imaging with FA-SIM has revealed dynamic changes in macromolecular crowding levels within organelles at super-resolution. II) Conventional 2D-SIM employs one-dimensional stripe patterns and rotates them at three angles to achieve uniform resolution. Here, to alleviate photobleaching and improve the temporal resolution of 2D-SIM, we develop triangle-beam interference SIM (3I-SIM), which generates a two-dimensional lattice pattern based on 3 radially polarized beam interference, which enhances the signal-to-noise ratio of the high-frequency components. Compared to conventional 2D-SIM, 3I-SIM reduces photobleaching and improves the temporal resolution to 242 Hz. Benefiting from the unidirectional phase shift, 3I-SIM provides 3-fold higher rolling frame rate than 2D-SIM to visualize fast biological dynamics.

Invited Speaker

17:00-17:20

Haoyu Li

Harbin Institute of Technology



Bio: Haoyu Li is a full Professor at Harbin Institute of Technology. He received his BE and ME in Electrical Engineering from Harbin Institute of Technology in 2009 and 2011, respectively. In 2015, he received his PhD in Electrical Engineering from University College Dublin, Ireland. In 2018, He joined Harbin Institute of Technology as a principal investigator in School of Instrumentation Science and Engineering. In 2022, he received the Excellent Young Scholars from National Natural Science Foundation of China, and in 2025, he received the Scientific Research Innovation Capability Support Project for Young

Faculty (U40). His mission is building advanced live-specimen super-resolution (SR) imaging techniques, as well as developing smart computational imaging algorithms across modalities including optical microscopy, acoustic or photoacoustic imaging, and even quantitatively mapping tool. In recent years, as the first/corresponding author, he has published more than 50 peer-reviewed journal articles including Nature Biotechnology, Nature Photonics, Nature Methods, Nature Communications, etc. He has applied nearly 50 invention patents, and over 20 patents have been granted. He developed a company that launched a research-grade domestic super-resolution microscope with independent intellectual property rights, with over 65 units delivered globally, including 3 overseas units, totaling more than 200 million RMB. His achievements have been selected as China's Top 10 Optical Breakthroughs (2022, 2024) and the Top 10 Social Influence Events in China's Optical Sector (2021, 2023, 2024).

Title: High-Throughput Super-Resolution Imaging in Live Cells

Abstract: Super-resolution (SR) imaging with high-throughput is invaluable to fast and high-precision profiling in a wide range of biomedical applications. However, prevalent SR methods require sophisticated acquisition devices and specific imaging control, and may cost a fairly long time on a single field-of-view. These essentially increase the construction difficulty, including challenges in imaging throughput, system establishment, and automation. Using the natural photophysics of fluorescence, fluctuation-based microscopy techniques can routinely break the diffraction limit with no need for additional optical components, but its long acquisition time still poses a challenge for high-throughput imaging or visualizing transient organelle dynamics. Here, we propose an SR method based on the Auto-Correlation with two-step Deconvolution (SACD) that reduces the number of frames required by maximizing the detectable fluorescence fluctuation behavior in each measurement. By applying continuity and sparsity joint constraint, the Sparse deconvolution-assisted SACD enables 4D live-cell SR imaging of events such as mitochondrial fission and fusion. As an open-sourced module, we anticipate SACD can offer direct access to SR, which may facilitate the biology studies of cells and organisms with high-throughput and low-cost.

Invited Speaker

17:20-17:40

Qihang Zhang

Chinese University of Hong Kong

Bio: Qihang Zhang is a Research Assistant Professor in the Department of Biomedical Engineering at the Chinese University of Hong Kong (CUHK). He received his Bachelor degree in Department of Physics from Tsinghua University in 2018 and his PhD in Electrical Engineering and Computer Science from Massachusetts Institute of Technology in 2023, followed by a postdoctoral training at Singapore-MIT Alliance of Research and Technology and Tsinghua University before joining CUHK in 2025. His research interest is in computational scattering optics. He has published in Science, Nature Communications, Light: Science and Applications, Optics Letters, etc.

Title: Interferometric Quantitative Phase Microscopy for Nanometrology Applications

Abstract: Interferometric quantitative phase microscopy (iQPM) is a promising technique for nanometrology by offering high measurement precision and throughput. I will first highlight our recent advances in iQPM and their applications on characterization of micron and nano structures. Then, I will present our results on pushing the measurement accuracy limit to sub-angstrom or beyond to measure the hidden electronic-behaviors in atomic structures by developing the Picometer-sensitivity Interferometric QPM (π QPM) and lately the phase amplification microscopy (Φ -Amp). After that I will introduce our development of embedded defect detection in 3D multi-layer structures by the wavelength-scanning QPM. Finally, I will show our work on high-speed 3D iQPM and its deployment for in situ characterization of 3D-printed structures through two-photon polymerization.

Technical Sessions

D2-PM-B13: Award Finalist Session: Best Student Paper

16:00-18:00, April 18, 2026 **Convention Hall D**

Session Chairs: Sixing Xu, HNU; Renxin Wang, NCU

16:00-16:15	**Paper ID:** Oral# 68 **Paper Title:** A Flexible Pressure Sensor Based on Two-Stage Electrical Contact for Enhanced Sensitivity and Linear Range **Presenter:** Yuanpeng Lin, Xiamen University
16:15-16:30	**Paper ID:** Oral# 76 **Paper Title:** A High-Density Floating Microelectrode Array for On-Chip Neural Signal Monitoring **Presenter:** Xingming Wen, ShanghaiTech University
16:30-16:45	**Paper ID:** Oral# 83 **Paper Title:** Multi-Ring Electrode PMUT with High Acoustic Pressure and High Directivity for Enhanced Low-Frequency Ultrasonic Neuromodulation **Presenter:** Xinyue Zhang, Peking University
16:45-17:00	**Paper ID:** Oral# 90 **Paper Title:** High-Precision Gas Content Detection in Microfluidic Chips Based on PMUTs and Machine Learning **Presenter:** Hongqiang Tan, Xi'an Jiaotong University
17:00-17:15	**Paper ID:** Oral# 101 **Paper Title:** Personalized Reverse Iontophoresis-based Non-Invasive Continuous Glucose Monitoring via Multi-Parameters Coupled Machine Learning **Presenter:** Wangwang Zhu, Tianjin University
17:15-17:30	**Paper ID:** Oral# 103 **Paper Title:** Simulation of Metasurface Structures for Mid-Infrared Narrowband Filter **Presenter:** Wenbo Wang, Shanghai Institute of Microsystems and Information Technology, Chinese Academy of Sciences
17:30-17:45	**Paper ID:** Oral# 105 **Paper Title:** A Decoupling Design Based on Differential-Mode Cancellation and Common-Mode Superposition for High-Shock Triaxial MEMS Accelerometer **Presenter:** Weihang Zhang, Beijing Institute of Technology
17:45-18:00	**Paper ID:** Oral# 117 **Paper Title:** A Sensitivity-Enhanced MEMS-ASIC Integrated Thermal Flow Sensor Based on an Improved Constant Temperature Difference Control Scheme **Presenter:** Kai Qiao, Beijing Institute of Technology

Technical Sessions

D3-PM-A01: Emerging Electromechanical Transduction and Multimode Sensing

13:30-15:00, April 19, 2026 **Meeting Room 301A**

Session Chair: Zhaoling Li, Donghua University

Keynote Speaker

13:30-14:00

Chenguo Hu

Chongqing University

Bio: Chenguo Hu is a professor of physics in Chongqing University. Associate Editor of Nano Energy and Research. She earned her Ph.D. from Chongqing University in 2003. Her research focuses on surface and interface physics, and related functional devices, particularly making innovative contributions to the fields of triboelectric nanogenerators and self-powered sensors. She has published more than 350 papers in Sci. Adv., Nature Commun., Sci. Robotics, Nature Sustain., Adv. Mater., EES, etc. with more than 28,000 SCI citations. Her h-index is 88. She has won 2 first and 2 second prizes in provincial-level Natural Science Awards. She is an expert who received the state council issued a Special Government Allowances. She was recognized as a Highly Cited Researcher by Clarivate Analytics in 2022-2025.

Title: Boosting Output Performance and Energy Utilization of Triboelectric Nanogenerator

Abstract: Triboelectric nanogenerator (TENG) is a new technology for collecting low-frequency mechanical energy, which is one of the most important technologies to solve distributed energy supply of wireless sensor networks where the wired electricity is not available. However, it is a great challenge to improve the output energy density, reduce interface abrasion and efficiently extract energy for electronics. Herein, I will introduce the strategies adopted in our research group to improve the output performance and durability, and energy utilization of the TENG, which include (1) boosting output charge density enabled by charge excitation strategy, self-polarization of polar high-k materials, charge trapping failure of dielectric polymers, ultra-fast charge injection technique, charge migration in dielectric materials, etc., (2) improving durability, and (3) efficient energy managements. Through multi-dimensional analysis and regulation of charge behavior, these works have made substantial advancements in optimizing the performance of TENG and provided a theoretical foundation for the development of high-energy-density, self-powered TENG systems.

Invited Speaker

14:00-14:20

Yan Zhang

University of Electronic Science and Technology of China

Bio: Professor Yan Zhang is a leading researcher in piezotronics, piezo-phototronics, and self-powered wireless sensor system. His research established how strain-induced polarization in piezoelectric semiconductors modulates charge transport, energy conversion, and quantum states, enabling the design of high-performance nanoelectronic and quantum devices. He has developed quantum piezotronic models that elucidate mechanisms for quantum transport, spin–valley coupling, and qubit manipulation through piezopotential engineering. He has authored over 200 peer-reviewed articles, with more than 13,000 citations and an h-index of 71. He is a Senior Member of IEEE, listed in "2024 Elsevier Highly Cited Chinese Researchers (Physics)" and co-authored the monograph Piezotronics and Piezo-Phototronics (Springer).

Title: Quantum Piezotronics for Quantum Computing

Abstract: Qubit plays an important role in quantum computing and quantum information processing. Rabi frequency is a key performance index for estimating the speed of spin and valley qubits manipulation in devices. The piezotronic transistors based on quantum materials are a new mechanically manipulating devices using by the piezotronic effect. This study can be beneficial to manipulation of spin qubits by strong RSOI induced by quantum piezotornic effect, and will stimulate an intense researching interest in low-dimensional quantum piezotronic devices for quantum computing. We systematically investigate the piezopotential and piezoelectric field of MoS2, MoSe2, MoTe2, WS2, WSe2 and WTe2 and explore the effect of piezoelectric field and deformation potential on the band structure and electron transport characteristics of TMDs. It is found that the piezoelectric field has a dominant influence on the spin and valley transport and polarization characteristics. We explored the piezoelectric field of ML TMDs under strain regulation, and found that a strong piezoelectric field of 1 MV/cm can be achieved at the ferromagnetic interface. The results show that Rabi frequency increases from 385 MHz to 4200 MHz by applying strain, increased by 11 times, which shows an excellent effect of strain on the modulation of the valley qubit. This study provides a complete theoretical guidance for exploring piezoelectric regulation of spin and valley transport and the application of quantum piezotronics in the field of quantum computing is expanded.

Invited Speaker

14:20-14:40

Weiguo Hu

Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences

Bio: Weiguo Hu is currently a researcher at Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences. He Prof. Hu focus on the research of GaN piezotronic theory, wafer growth, and the fabrication of electronic/optoelectronic devices

since 2004. He has published more than 150 papers and cited more than 10000 times in journals such as nature communications and science advances; In addition, he co-wrote the monograph piezotronics and piezo photonics: applications to third generation semiconductors.

Title: Piezotronics Effect and GaN Power Devices

Abstract: AlGaN/GaN HEMT has unique advantages on high-power and high-frequency applications owing to the high carrier concentration, high carrier mobility and large breakdown voltage. And Piezoelectric/spontaneous polarization plays a key role in two-dimensional electron gas (2DEG) formation and carrier transportation. In this work, we developed the energy band theory by coupling the constitutive equations, Poisson equation and Schrodinger equation to describe the stress-electricity-heat coupling mechanism. With this model, we analyzed the spatial distribution and temporal evolution of Joule heating in power devices under current injection, which reveals the heat accumulation process and provides guidance for thermal regulation. And then, we developed the low-resistance ohmic contact process with TiAl/Au and TiAlTa/Au alloys in AlGaN/GaN HEMT. The main mechanism was attributed to the direct contact with two-dimensional electron gas (2DEG) through the substitution of the TiN compound with a smaller area Au dominated penetration. Finally, the AlGaN/GaN HEMT cantilever were fabricated by combining the anisotropic/isotropic dry etching process. This device preliminary exhibited the potential in autonomous power control due to the high power output and sensitive stress sensing. These studies deepen our understanding on piezotronics, and provide a new way to optimize the performance of GaN power electronic devices. In additional, they are expected to develop new applications such as autonomous driving, bionic robot, automatic control and so on.

Invited Speaker

14:40-15:00

Quan Wen

Chongqing University

Bio: Wen Quan is a Professor at the School of Optoelectronic Engineering, Chongqing University. He serves as the Chief Scientist of the National Key Research and Development Program of the Ministry of Science and Technology, an Academic Leader in "Instrument Science and Technology" in Chongqing, and a recipient of the Chongqing Outstanding Youth Science Fund. His research focuses on micro-nano devices and systems based on resonance mechanisms.

As the principal investigator, he has led numerous national-level scientific research projects, including those under the National Major Scientific Instruments and Equipment Development Program and the National Natural Science Foundation of China. In recent years, he has published over 40 papers, been granted 7 invention patents, and has 5 patents publicly disclosed. He has also received a first-class provincial Award for Technological Invention.

Title: MEMS-based Tunable Optical Devices

Abstract: Spectroscopic analysis and detection equipment is essential in fields such as medical testing,

food safety, environmental monitoring, industrial and agricultural production, and aerospace. The core components of such equipment are the spectroscopic and scanning devices. However, due to limitations in fabrication processes and device integration methods, traditional spectroscopic analysis instruments predominantly rely on discrete spectroscopic and scanning components. This approach suffers from issues such as large size, high power consumption, difficult alignment, and high costs, which have severely restricted the development of compact, low-power, high-performance spectroscopic analysis equipment and related technologies. This report will address the demands of micro-spectroscopic detection for next-generation core components. It will introduce research progress in resonant MEMS-based tunable micro-nano optical devices and systems, with an emphasis on the fabrication and integration technologies of MEMS-based integrated scanning grating micromirrors and their potential applications in high-performance light sources, micro-spectroscopic analysis, and hyperspectral imaging.

Invited Speaker

15:00-15:20

Huan Hu

Zhejiang University

Bio: Dr. Huan Hu is a Tenured Associate Professor and Ph.D. supervisor at Zhejiang University. He holds a bachelor's and master's degree from Tsinghua University and a Ph.D. from the University of Illinois at Urbana-Champaign (UIUC). He completed his postdoctoral research at IBM Watson Research Center in the United States. He focuses on advanced nano-manufacturing technology, biomimetic micro-nano sensors, and lab-on-chip technologies integrated with nanotechnology. He has published 86 peer-reviewed papers in prestigious journals such as PNAS, Advanced Materials, and Nature Communications. He has 19 granted U.S. patents and 11 granted Chinese patents, with two of his inventions commercialized into tech startups. In 2023, he was awarded the Bronze Prize in the "Invention and Entrepreneurship Award Project" by the China Association of Inventions. Dr. Hu serves as a council member of the Micro-Nano Devices and Systems Division of the China Instrument and Control Society, the Micro-Nano Measurement and Instrumentation Division of the Chinese Society for Micro-Nano Technology, and the Zhejiang Optical Society.

Title: Scanning Joule Expansion Microscopy for Next-Generation Electronic Device Measurement

Abstract: The continuous scaling of electronic and optoelectronic devices has led to rapidly increasing power densities, making nanoscale thermal management a critical challenge for device performance and reliability. Accurate mapping of localized temperature distributions is therefore essential for understanding heat generation, transport, and failure mechanisms in emerging nanoelectronic systems. Scanning Joule Expansion Microscopy (SJEM), an atomic force microscopy (AFM) – based thermomechanical technique, has emerged as a powerful platform for nanoscale thermal characterization by detecting periodic surface deformation induced by electrically driven Joule heating. This talk will present the history and milestones of SJEM [1,2] as well as our groups' recent development called lateral SJEM – L-SJEM [3]. L-SJEM achieves sub-picometer resolution (0.37 pm) in displacement measurement

and enhances the thermal measurement resolution of SJEM by more than an order of magnitude. L-SJEM utilizes the torsional bending of the micro-cantilever, rather than normal bending, to amplify the movement of the reflected laser spot. This method requires no custom probes or additional equipment and can be seamlessly applied to various AFM-based deformation measurements. This work provides valuable guidance for high-precision characterization and analysis of materials and devices at the nanoscale.

Technical Sessions

D3-PM-A02: Flexible Functional Materials and Devices

13:30-15:30, April 19, 2026 **Meeting Room 301B**

Session Chair: Weili Deng, Southwest Jiaotong University

Keynote Speaker

13:30-14:00 **Xian Huang**

Tianjin University

Bio: Xian Huang is currently a Professor at the School of Precision Instrument and Optoelectronics Engineering in Tianjin University. He received his Ph.D. degree in Mechanical Engineering from Columbia University in 2011 and worked as a Postdoctoral Researcher in the University of Illinois at Urbana Champaign from 2011 to 2014. He then worked as an Assistant Professor in the Department of Mechanical Engineering in Missouri University of Science and Technology before returning to China in 2016. His major research area is flexible electronics for intelligent sensing. He has published more than 120 papers and obtained 45 authorized patents.

Title: 3D Flexible Probe Arrays for High-Fidelity Wafer-Level Optoelectrical Sensing and Characterization

Abstract: The rapid proliferation of MicroLED displays and high-density optoelectronic integrated circuits has intensified the demand for non-destructive, high-throughput wafer-level testing. Traditional rigid probing technologies often struggle with surface topography variations across large-area wafers, leading to inconsistent contact resistance and potential mechanical damage to fragile thin-film structures. This presentation presents various types of 3D flexible probe arrays designed to achieve conformal and stable optoelectrical sensing at the wafer level. The 3D probe arrays exhibit exceptional mechanical compliance, enabling uniform contact across non-planar surfaces and significantly reducing contact resistance while preventing surface scratching. To further optimize sensing performance, the probe tips are integrated with nanoforest-based electrodes, providing a high-surface-area interface that enhances charge transfer and minimizes thermal noise during low-current measurements. Experimental results demonstrate that the 3D flexible arrays maintain stable electrical connectivity and high-fidelity optical signal collection over repeated cycles. The integration of these arrays into a reconfigurable multi-physics platform enables simultaneous mapping of electrical characteristics and optical efficiency with high precision. This technology offers a robust solution for the "Known Good Die" (KGD) challenge, paving the way for more efficient and reliable production of next-generation flexible electronics and large-scale optoelectronic systems.

Keynote Speaker

14:00-14:30

Inkyu Park

KAIST

Bio: Prof. Inkyu Park received his B.S., M.S., and Ph.D. from KAIST (1998), UIUC (2003) and UC Berkeley (2007), respectively, all in mechanical engineering. He has been with the department of mechanical engineering at KAIST since 2009 as a faculty member and is currently a full professor and KAIST Endowed Chair Professor. His research interests are micro/nanofabrication, smart sensors for healthcare, environmental and biomedical monitoring, and flexible & wearable electronics. He has published more than 222 SCI journal articles (45+ cover articles) and 50+ patents in the area of MEMS/NANO engineering, and his publications have been cited more than 22,381 times (h-index=69) as of Jan 2026. He is a recipient of HP Open Innovation Research Award (2009-2012), KAIST Prize for Academic Excellence (2021), KAIST Grand Prize for Technology Innovation Award (2019), Top 10 Nanotechnology of Korea (2023), and Minister Award from Ministry of Science and ICT (2023). He is also a fellow (academician) of Korean Academy of Science and Technology (KAST) and a general member of National Academy of Engineering of Korea (NAEK). At present, he holds the position of editor for Sensors and Actuators B: Chemical (Elsevier), a top-ranked SCI journal in the field of chemical sensor technology.

Title: Mechanics-Driven Design of Flexible and Stretchable Systems for Tactile Sensing and Hybrid Integration

Abstract: The evolution of flexible and stretchable electronics demands innovative material architectures and fabrication methodologies that can simultaneously enhance mechanical compliance, electrical performance, and structural integration. In this talk, I will present a synergistic approach that combines bioinspired geometries, thermoformed 3D microstructures, and interfacial engineering to address long-standing challenges in tactile sensing and hybrid electronic integration.

First, I introduce a capacitive pressure sensor featuring a beetle-inspired gradient slant structure (GSS) as its dielectric layer. By mimicking the compliant slanted hairs of beetles, the sensor achieves an ultra-broad linear response range (up to 130 kPa) and high sensor-to-sensor uniformity through a 3D-printing-based fabrication process. The sequential contact mechanism of gradient pillars ensures linear capacitance variation and high sensitivity (0.12 kPa^{-1}), offering excellent potential for electronic skins and wearable health-monitoring platforms.

Second, I discuss a thermoformed 3D electronics (T3DE) platform for customizable tactile sensors. By converting 2D thermoplastic films into deformable 3D structures, this platform achieves ultra-wide modulus tunability (10 Pa – 1 MPa), negligible hysteresis (<0.5%), and fast response time (0.1 ms). The capacitive sensors based on T3DE demonstrate high sensitivity (up to 5,884 kPa^{-1}) and outstanding performance from subtle acoustic wave detection to human-body load monitoring. This modularity enables scalable and application-specific sensor development across robotics, HCI, and medical wearables.

Third, to bridge the mechanical mismatch between rigid and stretchable electronics, I present our

bioinspired omnidirectional interfacial-engineered flexible island (BOIEFI) design. Mimicking plant root systems, BOIEFIs feature hierarchical mechanical interlocking that facilitates seamless stress transfer at the interface. These structures enable high stretchability (>500%), enhanced fatigue life, and are demonstrated in functional stretchable devices, including LED displays and human-machine interfaces and smart resistance bands for workout monitoring.

Altogether, these advancements outline a material- and mechanics-driven roadmap for next-generation flexible systems. By leveraging bioinspired design, thermoforming techniques, and structural mechanics, we move closer to realizing robust, scalable, and multifunctional electronics that are compatible with complex and dynamic real-world environments.

Invited Speaker

14:30-15:50

Nanjia Zhou

Westlake University

Bio: Nanjia Zhou is the first full Yungu Professor at Westlake University, and he is also the Assistant Director of the Research Center for Industries of the Future. In 2019, Nanjia was awarded the Young Thousand Talents Program. His research focuses on the development of equipment, materials, and engineering processes in printed electronics and electronic additive manufacturing. He obtained his Ph.D. in Materials Science and Engineering from Northwestern University in 2015, under the guidance of U.S. Academician Tobin J. Marks. As one of the eight awardees nationwide, Nanjia was awarded the Dreyfus Foundation Postdoctoral Fellowship, and then he joined the research team of Jennifer A. Lewis, a world-leading scientist in 3D printing at Harvard University. In 2018, he joined Westlake University full-time. In 2019, he was named as one of the "35 Innovators Under 35" in the China region by MIT Technology Review. He received the Qiu Shi Foundation Young Scholar Award in 2020, and awarded as a Zhejiang Youth Sci-Tech Entrepreneur in 2025. In 2020, he incubated his first company, Enovated 3D, at the School of Engineering, Westlake University.

Title: Micro-nano Electronic Additive Manufacturing Technology and Applications

Abstract: Conventional microelectronics are manufactured using the photolithography process, which requires a substantial initial investment in machinery and production lines, and results in high operational costs, limited process flexibility, and significant material waste. The future of industry is being shaped by additive manufacturing technology, which offers significant benefits in the areas of rapid prototyping, sustainable processing, intelligent manufacturing, and customized production. In particular, additive manufacturing has the potential to generate micro-components and interconnections for the sensing and transfer of information in the disciplines of advanced packaging, flexible electronics, and soft displays. Additive manufacturing technology is being implemented by universities, research institutions, and technology companies to develop and fabricate three-dimensional circuits, antennas, sensors, and other electronic devices. The purpose of this report is to introduce material synthesis methods for precision electronic additive manufacturing technology, precision printing technology solutions, and mass

production-level processing equipment. The focus will be on the application of these methods in chip packaging, microsystem integration, and novel display technologies.

Invited Speaker

14:50-15:10

Xu Yan

Jilin University

Bio: He is from the School of Electronic Science and Engineering at Jilin University, China. His research focuses on enzyme-based sensors and detection devices for pesticides. He has published over 70 papers indexed by the Science Citation Index (SCI) as first or corresponding author in Advanced. Funct. Mater., ACS Nano and Biosens. Bioelectron. He was selected for the ‘Postdoctoral Innovation Talent Support Programme’. He is a Young Editorial Board Member for journals including Research, Wearable Electronics and the Journal of Analysis and Testing.

Title: Pesticide Biosensor and Devices

Abstract: Pesticides play a critical role in modern agriculture, ensuring food security and generating enormous economic benefits. However, the massive use and inappropriate misuse of pesticides has also hindered the development of sustainable agriculture, causing food safety and environmental pollution problems. In particular, on-site analysis of pesticides is of great importance for environmental monitoring, food safety and health assessment. Enzyme-based sensor technology is currently the mainstream method for pesticide detection, but its sensitivity and stability are poor. Our group constructed a series of high-performance enzyme-based biosensors from the three aspects of sensor sensing, transducing and system to realize rapid pesticide detection in the field. We provide solutions for the realization of highly sensitive pesticide enzyme-based sensors in the design of sensing materials, the investigation of sensitization mechanism, and the construction of new analytical platforms.

Invited Speaker

15:10-15:30

Hongjie Hu

Peking University

Bio: Dr. Hongjie Hu is an Assistant Professor in the School of Integrated Circuits at Peking University. He received his Ph.D. in Materials Science and Engineering and completed postdoctoral training in the Aiiso Yufeng Li Family Department of Chemical and Nano Engineering, both at the University of California San Diego. His research is dedicated to the development of wearable ultrasound technologies for continuous imaging of deep tissue and central organs. He has published numerous first-author papers in Nature, Nature Biomedical Engineering, Nature Reviews Materials, Nature Communications, Science Advances among others. His research has been reported by the Wall Street Journal, the U.S. National Institutes of Health, and many well-known academicians and experts. Dr. Hu received the Hisako Terasaki Young Innovator Award in 2023 in recognition

of his contribution to the field of biomedical Engineering, and iCANX Young Scientist Award in 2025.

Title: Wearable Ultrasound Imaging Technologies

Abstract: Ultrasound imaging technologies play a pivotal role in clinical diagnostics. However, the bulky design, operator dependence, and intermittent acquisition of conventional probes limit their utility for continuous monitoring in acute, chronic, and high-risk conditions. Recent advances in soft functional materials, micro – nano fabrication, and integrated packaging have spurred the development of wearable ultrasound technologies. By combining high-sensitivity piezoelectric arrays, stretchable conductive networks, and biocompatible multifunctional encapsulation, the wearable ultrasound devices preserve the imaging precision of traditional ultrasound while enhancing skin conformability, sensing continuity, and responsiveness to dynamic physiological changes. In addition, this technology adds a new sensing dimesion to the wearable platform that enables continuous imaging of deep tissues and central organs. It supports multimodal functions such as anatomical imaging, cardiac function assessment, hemodynamic analysis, and deep-tissue biomechanics. This paradigm extends wearable health technologies into deep physiological monitoring, with transformative potential for smart healthcare, chronic disease management, and consumer health solutions.

Technical Sessions

D3-PM-A03: Flexible Biosensors

13:30-15:40, April 19, 2026 **Meeting Room 301C**

Session Chair: Yu Song, City University of Hong Kong

Keynote Speaker

13:30-14:00 **Xi Xie**

Sun Yat-sen University

Bio: Prof. Xi Xie is currently a full professor in the School of Electronics and Information Technology at Sun Yat-sen University, and was awarded by the National Science Fund for Distinguished Young Scholars. He graduated from Stanford University in USA with PhD degree, and then worked as a postdoc researcher in the Prof. Robert Langer's lab at Massachusetts Institute of Technology. On 2016, he started his own research lab at Sun Yat-sen University. Prof. Xi Xie has been focusing on the research on minimally invasive biosensing technologies. As corresponding author, >100 manuscripts have been published on journals including Nature Materials (2025), Nature Sensors (2026), Nature Biomedical Engineering, Nature Nanotechnology, Nature Communications, Science Advances Nature Protocols, Nature Review Materials and et al. He has applied for >100 patents. He was also awarded by "MIT Technology Reviews Innovators Under 35 China", the "Outstanding Scientific Award of Chinese Institute of Electronics", and the "Microsystems & Nanoengineering Summit 2019 Young Scientist Award". He serves as Associate editor in Microsystems & Nanoengineering (Nature Publishing Group, JCR Q1) and Bio-designs and Manufacturing (JCR Q1).

Title: Minimally Invasive Bioelectronics

Abstract: Biomedical sensing is the key to access biological information. In recent years. The development of biosensing has gradually evolved from detection from blood detection level to in situ detection on tissue or cellular level. The technology of detection has also evolved from single point detection, to in situ sensing for long time or even sensing with high resolution. Among the existing in situ biosensing technologies, non-invasive sensing does not reach the detection target in the tissue, making it difficult to accurately reflect the real situation. Invasive sensing through implanted devices, on the other hand, has safety concerns. Therefore, how to balance safety and accuracy has been challenging in the field of biosensing. Microneedle arrays, as a minimally invasive technology, can balance the accuracy of invasive sensing with the safety of non-invasive sensing. Our research of minimally invasive biosensing technology employs microneedle arrays as the core structure to penetrate skin layers or cell membranes minimally invasively to detect information in tissues or cells in vivo. The key technologies we have developed for minimally invasive devices consist of three aspects: first, the delicate preparation of microneedle arrays

and the preparation of highly sensitive sensing modules on the surface of microneedles; second, the development of technologies for efficient and safe penetration of microneedle arrays through tissue mucosa and cell membranes. The third is the design and development of miniaturized multifunctional circuit systems to support the functions of minimally invasive devices. The minimally invasive biosensing technologies we have developed have been validated and applied in penetrating cell membranes to record intracellular physiological signals, penetrating organ mucosa layers to measure biochemical signals in tissues, and penetrating skin layers to measure in vivo physiological signals, respectively. These minimally invasive biosensing technologies are expected to provide new tools and solutions for the diagnosis and treatment of major diseases.

Keynote Speaker

14:00-14:30

Xinge Yu

City University of Hong Kong

Bio: Xinge Yu is a Professor of Biomedical Engineering at City University of Hong (CityU), the Member of the Hong Kong Young Academy of Sciences, Young Member of Hong Kong Academy of Engineering. He is the Associate Director of Institute of Digital Medicine at CityU, Associate Director of Hong Kong Centre for Cerebro-cardiovascular Health Engineering. Prof Yu is the recipient of NSFC Distinguished Young Scientist Grant (Scheme A), RGC Research Fellow, NSFC Excellent Young Scientist Grant (Hong Kong & Macao), Innovators under 35 China (MIT Technology Review), New Innovator of IEEE NanoMed, MINE Young Scientist Award, Stanford's top 2% most highly cited scientists etc. Prof. Yu is the Associate Editor of Science Advances, Microsystem & NanoEngineering, Bio-Design and Manufacturing etc. Xinge Yu's research group is focusing on skin-integrated electronics and systems for VR and biomedical applications. He has published 200 papers in Nature, Nature Materials, Nature Biomedical Engineering, Nature Machine Intelligence, Nature Communications, Science Advances etc., and 50 patents filed/granted.

Title: Skin-Interfaced Air and Sweat Permeable Electronics for Biomedical Application

Abstract: Wearable electronics with great breathability enable a comfortable wearing experience and facilitate continuous bio-signal monitoring over extended periods. Current research on permeable electronics is predominantly at the stage of electrode and substrate development, which is far behind practical applications with comprehensive integration with diverse electronic components (for example, circuitry, electronics, encapsulation). Achieving permeability and multifunctionality in a singular, integrated wearable electronic system remains a formidable challenge. Here we present a general strategy for integrated moisture-permeable wearable electronics based on three-dimensional liquid diode (3D LD) configurations. By constructing spatially heterogeneous wettability, the 3D LD unidirectionally self-pumps the sweat from the skin to the outlet at a maximum flow rate 4,000 times greater than the physiological sweat rate during exercise, presenting exceptional skin-friendliness, user comfort and stable signal-reading behaviour even under sweating conditions. A detachable design incorporating a replaceable vapour/sweat-discharging substrate enables the reuse of soft circuitry/electronics, increasing

its sustainability and cost-effectiveness. We demonstrated this fundamental technology in both advanced skin-integrated electronics and textile-integrated electronics, highlighting its potential for scalable, user-friendly wearable devices.

Keynote Speaker

14:30-15:00

Lingqian Chang

Beihang University

Bio: Lingqian Chang is currently a Professor at Beihang University. He serves as the Vice Dean of the School of Medical Science and Engineering at Beihang University, Dean of the Institute of Medical Engineering and Translational Medicine, and Director of the Key Laboratory of Precision Theranostic Technology and Intelligent Imaging Equipment, Ministry of Industry and Information Technology (MIIT). His research focuses on nano-electroporation, drug delivery, and biochip technology. He has received national fundings for Distinguished Young Scholars (National Science Fund), Young Changjiang Scholar (Ministry of Education), Young Thousand-Talent (Organization Department), etc. As corresponding author, he has published over 80 papers in journals such as Nature, Cell, Nature Electronics, Nature Photonics, Nature Protocols, PNAS, Nature Communications, and Science Advances. He has also been recognized with the MIIT Outstanding Young Scientist Award, the Tengchong Young Scientist Award, the Zhong Nanshan Young Scientist Technology Innovation Award, and the 2024 China Top 10 Optical Breakthroughs. His technologies have been translated into clinical applications, completed three rounds of financing, filed for two medical device registrations, and have been deployed in more than ten top-tier hospitals across China.

Title: Cell Theranostic Biochips

Abstract: Accurate detection, diagnosis, and regulation of intracellular biomolecules in living cells underpin the precision diagnosis and treatment of major diseases such as cancer. However, in clinical practice, the cell membrane poses a significant barrier to transmembrane molecular transport, leading to pronounced technical bottlenecks in cellular diagnosis and therapy.

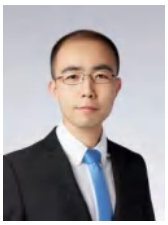
To address this challenge, the speaker has designed biochips based on nano-electroporation technology, enabling efficient, safe, and controllable cellular sampling and molecular delivery, which: (1) In cell therapy, increased in vivo delivery efficiency of gene drugs from < 1% (conventional delivery) to > 30%, demonstrating promising potential in applications such as organ injury repair, tumor treatment (Nature, 2025; Cell, 2026; Nature Electronics, 2024), and beyond; (2) In cellular diagnosis, reduced the detection time of clinical gene tests for lung cancer, breast cancer, etc., from two days to 30 minutes (Nature Photonics, 2024; PNAS, 2024); (3) In cellular detection, increased the sensitivity of rapid diagnosis of diseases such as lung cancer and influenza by 100 times compared to traditional PCR techniques (Nature Communications, 2023; Science Advances, 2024).

Invited Speaker

15:00-15:20

Ze Xiong

ShanghaiTech University



Bio: Dr. Ze Xiong is a Researcher in the School of Biomedical Engineering at ShanghaiTech University and received his Ph.D. from The University of Hong Kong. He previously served as a Research Fellow in the Department of Electrical and Computer Engineering, the N.1 Institute for Health, and the Institute for Health Innovation & Technology (iHealthtech) at the National University of Singapore. His research focuses on wireless and flexible bioelectronics that bring digital intelligence to clinical workflows and personalized healthcare. To date, he has published over 50 papers in leading journals including Nature Biomedical Engineering, Nature Materials, Nature Electronics, Science Advances, and Advanced Materials. His work has been featured by major media outlets such as Reuters, Scientific American, AAAS, and AIChE. He has received multiple honors, including the Emerging Investigator of China, the MINE Young Scientist Award, Shanghai Overseas High-Level Talent, iCANX Young Scientist Award finalist, JMCC Emerging Investigator, and Swissnex Fellow. Dr. Xiong serves on the Brain–Computer Interface Biomaterials Subcommittee of the Chinese Society for Biomaterials, the Special Committee on Science and Technology Innovation in Medical Devices of the China Technology Market Association, and the Youth Committee of the Nano-Oncology Professional Committee of the Chinese Anti-Cancer Association. He is also an editorial board member or early-career editorial board member for several journals, including the International Journal of Biomedical Engineering, FlexMat, Med-X, and The Innovation Materials. He is the principal investigator of projects funded by the National Natural Science Foundation of China (Excellent Young Scientists Fund and General Program) and the Shanghai Municipal Science and Technology Commission.

Title: Wireless and Flexible Bioelectronics for Digital Wound Management

Abstract: The smart integration of advanced wireless technologies with flexible electronics is enabling a new generation of wearable and implantable bioelectronic sensors with strong potential to advance digital healthcare. By providing personalized, continuous measurements, these devices can support more accurate and cost-effective assessment of disease presence and severity. They are particularly valuable for detecting and managing abnormal physiological conditions outside clinical environments—an advantage that becomes critical when timely care is limited by distance, resource constraints, or intermittent follow-up. Among unmet clinical needs, postoperative wound management remains a major challenge, in part because early detection of surgical complications is hindered by the lack of technologies that can interface directly with wounds and reliably transmit data to caregivers for timely intervention. This talk will highlight three recent developments: (1) a wireless, flexible DNA–hydrogel biosensor that conformally interfaces with wounds and enables smartphone-based infection monitoring; (2) a wirelessly operated bioelectronic suture capable of directly monitoring physicochemical states in deep surgical wounds; and (3) a lotus-inspired, low-friction multiphasic minisensor for wireless intracranial pressure monitoring with

near-ideal aeroelastic performance. Collectively, these wireless and flexible bioelectronic platforms represent a step toward scalable digital medicine and improved patient outcomes.

Invited Speaker

15:20-15:40

Minqiang Wang

Shanghai Jiao Tong University

Bio: Dr. Minqiang Wang is currently tenure-track associate professor in Shanghai Jiao Tong University at GIFT, before joining SJTU, he was a postdoctoral scholar at California Institute of Technology, under the supervision of Dr. Wei Gao. His research is interdisciplinary and focused on developing new types of versatile energy materials and bioelectronic wearable systems that could be used for fundamental and applied biomedical studies. His research interests include Nano-materials, Wearable devices, Biosensors, Bioelectronics, Analytical electrochemistry, Nanotechnology, Microfluidics, Personalized medicine, Electrocatalysis.

Dr. Minqiang Wang has published 21 scientific papers in journals such as “Nature Materials, Nature Biomedical Engineering, Nature Nanotechnology, Chemical Reviews etc.” as the first author or corresponding author. A total of citations is over 7, 500, and h-index is 41. He won the first-tier prize of Baxter Young Investigator (one out of six around the world).

Title: Wearable Bioelectronics for Personalized Medicine

Abstract: The rising research interest in personalized medicine promises to revolutionize traditional medical practices. This presents a tremendous opportunity for developing wearable devices toward predictive analytics and treatment. In this talk, I will introduce our efforts in developing wearable biosensors for non-invasive molecular analysis. Such wearables can autonomously access body fluids (e.g., human sweat) across the activities and continuously measure a broad spectrum of analytes including metabolites, nutrients, hormones, and drugs. Laser engraving and inkjet printing are used to manufacture high-performance nanomaterials-based biosensors at large scale and low cost. The clinical value of our wearable systems is evaluated through various human trials toward precision nutrition, stress/mental health assessment, chronic disease management, and drug personalization. These wearable technologies could open the door to a wide range of personalized monitoring, diagnostic, and therapeutic applications.

Technical Sessions

D3-PM-A04: Micro/Nano Integrated Devices and Circuit Design

13:30-15:00, April 19, 2026 **Meeting Room 302A**

Session Chair: Sixing Xu, Hunan University

Invited Speaker

13:30-13:50 **Qiu Xu**

Shanghai University of Engineering Science

Bio: Qiu Xu received the B.Sc. degree from Jiangxi Normal University, Nanchang, China, in 2003. He received the M.Sc. degree from Shanghai Normal University, Shanghai, China, in 2007. He received the Ph.D. degree in microelectronics and solid state electronics at the National Key Laboratory of Science and Technology on Micro/Nano Fabrication, Shanghai Jiao Tong University, Shanghai, China, in 2017. He worked as a postdoctoral fellow at King Abdullah University of Science and Technology from 2019 to 2023 in Saudi Arabia. He is currently a professor of Shanghai University of Engineering Science, Shanghai. His research interests include the design, simulation, and fabrication of MEMS/NEMS devices.

Title: Multi-threshold Inertial Switch with Acceleration Direction Detection Capability

Abstract: We present a novel inertial micro-electromechanical switch capable of detecting both the magnitude and direction of acceleration in the x-y plane through three distinct threshold levels. The device consists of a square proof mass with four movable electrodes—one on each side—surrounded by twelve flexible stationary electrodes, with three placed on each side. When an acceleration is applied, the movable electrodes come into contact with one or more of the stationary electrodes, depending on the magnitude and direction of the input. The specific combination of activated switches reveals the direction of acceleration. The design was validated through finite element simulations under various acceleration conditions. A prototype was fabricated using the SOIMUMPs process and experimentally tested using a drop-table system under different shock loads. Both simulation and experimental results show strong correlation, confirming that increasing the number of electrical switches enhances the accuracy and resolution of direction detection. This design offers a compact and effective solution for quantitative acceleration sensing in planar directions.

Invited Speaker

13:50-14:10

Yiliu Wang

Hunan University

Bio: My primary research focuses on metal halide perovskite materials and optoelectronic devices , specifically involving the synthesis of monocrystalline materials, device fabrication, processing techniques, and performance enhancement. Concurrently, I also conducts research on two-dimensional semiconductor materials and electronic devices.

Title: Research on Vapor-Phase Epitaxy of Metal Halide Perovskites and Related Advanced Device Assembly Techniques

Abstract: The inherent instability of metal halide perovskites makes them difficult to compatibilize with traditional semiconductor processes, posing a significant challenge for the integration of perovskite-based optoelectronic and electronic devices. To address this critical scientific issue, this series of works is dedicated to developing damage-free integration processes tailored for perovskite materials.

Using asymmetric vapor-phase epitaxy as a core technique, we have achieved the epitaxial growth of multi-component perovskite single-crystal thin films on various substrates. Based on this, stable perovskite p-n heterojunctions were obtained, and photodiode-type photodetectors exhibiting no significant increase in dark current at high temperatures were fabricated. Furthermore, by exfoliating the single-crystal thin films from the epitaxial substrates and combining this with van der Waals integration technology, we realized the heterogeneous integration of perovskite single-crystal thin films with arbitrary semiconductor substrates. This formed heterointerfaces with efficient charge transport, thereby overcoming the limitations of substrate lattice matching and surface wettability that previously constrained direct perovskite integration. Additionally, leveraging the pluggable transferability of the perovskite thin films, we achieved in-situ modulation of the local composition within the single-crystal thin films, successfully constructing perovskite single-crystal lateral heterojunctions. Finally, utilizing the single-crystal layered lead iodide template from vapor-phase epitaxy, we achieved selective delamination of perovskite layers in specific regions and high-precision patterning of micro-nano arrays, expanding its application potential in optoelectronic integration. The above series of processes all avoid the use of high-energy input or organic solvents, effectively preventing damage and contamination to the perovskite materials. They constitute a set of unique integration techniques specifically designed for the intrinsic properties of perovskite materials.

Invited Speaker

14:10-14:30

Xiwen Zhu

Harbin Institute of Technology

Bio: Xiwen Zhu received the B.S., M.S., and Ph.D. degrees from Harbin Institute of Technology, all in electronic science and technology. In 2024, he is currently an associate research fellow of Harbin Institute of Technology. His current research interests include energy harvesting ASIC, sensors interface ASIC, and power management ASIC design. Xiwen Zhu has achieved remarkable scientific researches with substantial academic significance and technological value in the areas of ASIC chips and intelligent microsystem technologies, with the performance reaching the international advanced level. He has 10 journal and conference papers (authored/co-authored) in the field of electronics and integrated circuits and has 12 patents granted/pending.

Title: Research on ASIC Chip for Micro-Energy Harvesting and Intelligent Management

Abstract: In the context of the booming development of the Internet of Things, environmental energy collection technology plays an increasingly important role in the field of wireless sensing, using this technology wireless sensor network nodes can achieve self-energy, to solve the problem of sensor equipment not easy to charge or replace the battery in harsh environments. It is necessary to design a matching environmental energy conversion power generation circuit to convert the output of the energy harvester into a voltage that can be utilized by the battery or application load. However, at present, the research of energy conversion power generation circuit is still in the initial stage. In addition, the application of composite management of micro-energy has also been widely concerned in recent years, but the current composite energy system management means are relatively simple, unable to cope with the randomness of the environment. In view of the above problems, this report will conduct in-depth research on DC environmental energy conversion circuit, AC environmental energy conversion circuit, intelligent compound energy management, and so on.

Keynote Speaker

14:30-15:00

Bo Zhao

Zhejiang University

Bio: Bo Zhao received the Ph.D. degree from EE Department of Tsinghua University, Beijing, China, in 2011. He worked in National University of Singapore and UC Berkeley (BWRC) from 2013 to 2018. Since 2018, he has been a Professor with the Institute of VLSI Design, Zhejiang University, Hangzhou, China. In 2024, he was rated as Qiushi Distinguished Professor of Zhejiang University. He has authored or coauthored more than 70 articles and book chapters. He holds more than 30 Chinese patents. His research interests include IoT radios, power harvesters, biomedical sensors, wireless systems, and wearable/implantable radios.

Dr Zhao was a recipient of the 2017 IEEE Transactions of Circuits and Systems Darlington

Best Paper Award, the Design Contest Award of the 2013 IEEE International Symposium on Low Power Electronics and Design, the Best Associate Editor of IEEE Transactions on Circuits and Systems I, as well as the Best Paper Award of the 2024 IEEE International Conference on Integrated Circuits Technologies and Applications (ICTA). He works as the International Technical Program Committee (ITPC) member of ISSCC. He was the Publication Chair for the 2016 IEEE Biomedical Circuits and Systems Conference. He serves as the Chair of IEEE Biomedical and Life Science Circuits and Systems Society, as well as an Associate Editor for the IEEE Transactions on Biomedical Circuits and Systems (2024-now)，IEEE Transactions on Circuits and Systems I (2020-2023), and IEEE Transactions on Circuits and Systems II (2026-now). Dr. Zhao also serves as a Committee Member of IEEE/C/SM.

Title: Wireless Biomedical Sensors--From 'Near Zero Power' to 'Battery Free'

Abstract: Wireless sensors are widely used in biomedical applications, such as ExG (EEG, EMG, and ECG) monitoring, neural recording, continuous glucose monitoring (CGM), cerebral oxygen monitoring (COM), touch sensing, temperature sensors, etc. A low-power wireless-sensing chip is required to enable a miniature battery size and a long lifetime. However, the battery in a traditional wireless sensor still adds to the overall size and needs periodic replacement. In comparison, battery-free wireless techniques lower the body burden and mitigate the biological responses for wearables and implants, respectively. In addition, the battery-free wireless techniques offer infinite life time for the biomedical sensors. In this talk, the wireless biomedical sensors will be listed and described, from near-zero-power techniques to battery-free techniques, including our recent works published in ISSCC and JSSC.

Technical Sessions

D3-PM-A05: AI for Micro/Nano Electro-Mechanical Systems

13:30-15:30, April 19, 2026 **Meeting Room 302B**

Session Chair: Xudong Zou, Aerospace Information Research Institute, CAS

Keynote Speaker

13:30-14:00 **Wei Wang**

Peking University

Bio: Professor at Peking Unviersity

Title: AI-Driven MEMS Intelligent Manufacturing

Abstract: As Micro-Electro-Mechanical Systems (MEMS) advance toward higher integration and complex multi-physics coupling, traditional manufacturing paradigms based on empirical "trial-and-error" face significant limitations in precision and development speed. Artificial intelligence (AI) has been proven to be a transformative engine that can empowers a broad spectrum of intelligent manufacturing paradigms. Building upon this foundation, this report proposes an AI-driven intelligent manufacturing framework for MEMS and demonstrates how these AI techniques effectively mitigate systemic uncertainty in the fabrication lifecycle. For critical single-step processes characterized by high uncertainty—such as Deep Reactive Ion Etching (DRIE)—the AI model achieves high-fidelity predictions of process outputs by mapping equipment parameters to physical outcomes, significantly reducing experimental costs and enabling automated searches for the optimal process recipe. In complex process chains where multiple stages are superimposed, the AI algorithms process high-dimensional data from Manufacturing Execution Systems (MES) to identify hidden correlations between process deviations and final device performance, thereby pinpointing the "killer variables" responsible for yield loss. The integration of AI in MEMS fabrication signifies a transformative shift from reactive trial-and-error toward intelligent manufacturing. This paradigm not only accelerates process development cycles and enhances manufacturing yields but also establishes the methodological foundation for transitioning MEMS fabs into digital twin manufacturing ecosystems.

Invited Speaker

14:00-14:20

Chong Li

Ocean University of China

Bio: Chong Li received the B.E. degree in Automation and the M.E. degree in Control Theory and Control Engineering from Ocean University of China, Qingdao, China, in 2009 and 2012, respectively, and the Ph.D. degree in Mechanical Engineering from Auburn University, Auburn, AL, USA, in 2016.

He is currently a Taishan Scholar Distinguished Professor with the Department of Automation and Measurement, Ocean University of China. From 2016 to 2018, he was a Postdoctoral Research Fellow with the Integrated MEMS Laboratory (IMEMS), Center for MEMS and Microsystems Technologies (CMMT), Georgia Institute of Technology. His research interests include MEMS, control systems, high-performance computing, and artificial intelligence.

Title: Artificial Intelligence for Micro Resonant Gyroscopes

Abstract: Micro resonant gyroscopes are widely used inertial sensors for navigation and motion sensing. Their performance is strongly influenced by the complexity of MEMS fabrication processes, intricate mechanical structures, and coupled electromechanical dynamics. Fabrication variations, structural asymmetry, environmental disturbances, and circuit nonidealities can introduce significant errors. These characteristics make micro gyroscopes a promising field for artificial intelligence (AI). AI could potentially assist many stages of the gyroscope lifecycle, including design, fabrication, signal processing, control, and calibration. However, most existing studies remain limited to relatively simple applications, such as temperature – error fitting networks.

This talk presents several recent efforts to i intelligent methods into micro resonant gyroscope systems. In the testing stage, an iterative learning control approach is applied to significantly improve the switching speed in the mode-reversal operation of the gyroscope. Intelligent control concepts are also employed to enable automatic parameter tuning for frequency matching and quadrature tuning functions. In addition, gyroscope errors are compensated using multi-source measurement data combined with internal physical information of the device. Furthermore, ongoing work explores the use of multimodal large models to analyze test data, structural information, and process indicators, with the goal of improving the yield and manufacturability of micro gyroscopes. These studies illustrate the potential of AI to move MEMS gyroscopes toward more intelligent and self-optimizing sensing systems.

Invited Speaker

14:30-14:50

Behraad Bahreyni

Simon Fraser University

Bio: Dr Behraad Bahreyni, SMIEEE, PEng, is a professor and the Director of the Intelligent Sensing Laboratory at Simon Fraser University, BC, Canada. He received his BSc from Sharif University of Technology, Iran, and MSc and PhD degrees in electrical engineering from the University of Manitoba, Canada, in 1999, 2001, and 2006, respectively. He was a post-doctoral researcher with the NanoSicence Centre at Cambridge University, UK, where he researched interface circuit design for microresonators. He joined SFU in 2008 after a one-year tenure in the industry as a senior MEMS design engineer. In 2016, he was with NXP Semiconductors, the Netherlands, developing advanced signal processing methods for sensing. His research activities are focused on the design and fabrication of micro/nano-sensors for applications that include consumer electronics, mining, automotive, and space exploration. Dr Bahreyni has contributed to more than 180 technical publications.

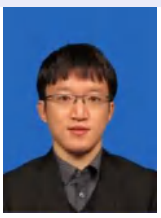
Title: Physical Intelligence and the Evolution of Cognizant Transducers

Abstract: Technological advances have provided abundant computing power, widespread connectivity, and various microsensors to quantify real-world parameters, leading to revolutions such as the Internet of Things (IoT) and wearable technologies. Increasingly, recognizing the context in which data is generated is more relevant than the raw sensor data itself. While sophisticated machine learning algorithms can process raw data to generate context, the ability to generate and record data has surpassed the capacity to make sense of it efficiently. The next paradigm in sensing systems is to integrate sensing and cognition at the sensor level, enabling pattern detection in data as it arrives without requiring extensive data transmission. This talk covers three such physical computers based on physical Reservoir Computing (RC) to detect patterns in data. First, an electrothermal computer is built using off-the-shelf components to tackle sophisticated contextual computations, including standard benchmarks and real-time event detection. We then demonstrate capabilities using 3D-printed computers for near-sensor signal processing. Finally, we will discuss the evolution of the work into building a physical computer with concurrent sensing and computing capabilities as a demonstration of in-sensor computing. We conclude with a roadmap towards implementing such capabilities at micro- and nano-scales.

Invited Speaker

14:50-15:10

Wuhao Yang



Aerospace Information Research Institute, Chinese Academy of Sciences

Bio: Wuhao Yang is currently an associate research fellow at Aerospace Information Research Institute, Chinese Academy of Sciences (AIRCAS). He received the B.Sc. degree in School of Mathematics and Physics from University of Science and Technology Beijing

(USTB) in 2013 and the Ph.D. degree in School of Physics from Peking University (PKU) in 2018. And then he joined Aerospace Information Research Institute, Chinese Academy of Sciences (AIRCAS), as an assistant research fellow. In 2024, he received funding from the National Natural Science Foundation of China for Young Scientists. His research field covers the fundamental study of micro/nano resonators, intelligent sensing technology, as well as the fabrication of micro- or nanostructured sensors.

Title: Nonlinear Dynamics in Ferroelectric Hf0.5Zr0.5O2 Thin Films for NEMS-Based Neuromorphic Computing

Abstract: The rapid advancement of emerging technologies such as artificial intelligence (AI) and the Internet of Things (IoT) demands a paradigm shift from traditional von Neumann architectures to energy-efficient, in-sensor data processing.

The ferroelectric thin films such as hafnium zirconium oxide (Hf0.5Zr0.5O2, HZO) into nano-electro-mechanical systems (NEMS) offers a new frontier for high-performance neuromorphic computing and intelligent sensing through nonlinear physical dynamics. This work delves into the dual-source nonlinearity of HZO-based nano resonators, specifically focusing on the transition from linear piezoelectricity to high-field electrostrictive regimes and the incorporation of ferroelectric hysteretic memory. We demonstrate that the quadratic nature of electrostriction under high-field excitation serves as a powerful driver for mechanical Duffing nonlinearity and parametric resonance, providing the complex state-space required for Physical Reservoir Computing (PRC). Furthermore, the inherent ferroelectric hysteresis of HZO introduces history-dependent weight modulation, enabling non-volatile "memory-based" nonlinearity that mimics biological synaptic plasticity.

Invited Speaker

15:10-15:30

Cosmin Roman

ETH Zürich

Bio: Cosmin Roman received the M.Sc. degree in electrical engineering from the Politehnica University of Bucharest, Bucharest, Romania, in 2002, and the Ph.D. degree in micro and nanoelectronics from the National Polytechnic Institute of Grenoble (INPG), France, in 2006, with a focus on modeling carbon nanotube sensors. He is currently a Senior Researcher with ETH Zürich. He has coauthored more than 90 scientific publications in journals or conferences papers. His expertise is multi-physics and compact modeling of transducers. His current research interests include sensor concepts for energy efficient applications, implantable devices based on acoustic metamaterials, and machine learning techniques for sensor applications.

Title: Physics-Informed Autoencoders for Sensor Signal Analysis

Abstract: Sensors collect data from the environment to support a vast range of applications. All sensors require some form of feature extraction to transform sensor output signals for further analysis. This can be as simple as a lookup table. However, in many other cases, the relevant information is implicit within the multidimensional sensor output and requires more analytical effort to extract. In this talk, we present our

recently introduced method, the Physics-Informed Autoencoder (PIAE), for feature extraction and dimensionality reduction of implicit, multidimensional sensor measurement data. This approach builds upon classical autoencoders (AE), retaining their strengths while adding physical interpretability to the latent space. We demonstrate our method using several measurement datasets from Carbon Nanotube Field-Effect Transistor (CNT-FET) gas sensors. The selected features, derived from transistor transfer characteristics, correspond to four typical parameters: the threshold voltage, the subthreshold swing, the current in the ON state and the transconductance. Furthermore, we illustrate the usefulness of the extracted features by successfully analyzing gas concentrations in mixture of multiple gases.

Technical Sessions

D3-PM-A06: Micro-Nano Chemical Sensor

13:30-15:10, April 19, 2026 **Meeting Room 305**

Session Chair: Ting Wang, Nanjing University of Post and Telecommunications

Invited Speaker

13:30-13:50

Kewang Nan

Zhejiang University

Bio: Prof. Kewang Nan is a ZJU100 Young Professor in the School of Pharmacy at Zhejiang University, and an adjunct professor at the Second Affiliated Hospital of Zhejiang University School of Medicine. His main research efforts lie on the development of bio-electronics for closed-loop therapies and drug delivery. He completed his Ph.D. and postdoctoral training at University of Illinois at Urbana-Champaign and MIT, with Prof. John A Rogers and Prof. Robert S Langer, respectively. He is the first/corresponding author of more than 30 journal articles including Nature Materials (2018), Nature Biomedical Engineering (2022), multiple Nature Communications (2024, 2024, 2025), Science Advances (2018, 2025), and multiple Nature Reviews (2022, 2025, 2026), and held more than 10 PCT and Chinese patents. He serves as young editorial board member for Med-X and Soft Science, and was co-organizing chairs for international conferences such as the IEEE-NSENS and the BMES Annual Meeting.

Title: Bioelectronics for Encapsulated Cell Therapy

Abstract: Drosophila larvae serve as a versatile model for elucidating gene functions relevant to human muscle and neurological disorders. Yet, conventional genotyping and phenotyping methods remain labor-intensive, low-throughput, and frequently depend on invasive or toxic procedures that perturb native physiology. In this talk, I will present a scalable bioelectronic platform that enables real-time, simultaneous mechano-electrophysiological recording from freely moving Drosophila larvae in an open three-dimensional (3D) environment, facilitating high-throughput cross-modal genotype mapping (CMGM).

Invited Speaker

13:50-14:10

Yan Wang

Guangdong Technion-Israel Institute of Technology

Bio: Dr. Yan Wang is currently a tenured Associate Professor at Guangdong Technion. She received her Ph.D. in Chemical Engineering from Monash University in 2018 and completed postdoctoral training in the Department of Electrical and Electronic Engineering at the University of Tokyo in 2021. In soft electronics field, she has published over 70 peer-reviewed articles, including more than 40 as first or corresponding author, in leading journals such as Science Advances (3 papers), Nature Communications, Proceedings of the National Academy of Sciences, Chemical Society Reviews, and Advanced Materials, with an h-index of 36 and five ESI Highly Cited Papers. And she is also an inventor on multiple patents filed in Australia, Japan, the United States, and China. Her work has earned several awards, including Stanford University & Elsevier Scopus TOP 2% Scientists (2021 – 2025), the Guangdong Province Major Talent Program (Youth), ACS Publications Award for Women Scientists in Surface and Interface Science (2025), the JMCC Emerging Investigators Award (2025), the Nanoscale Emerging Investigators Award (2023), and the 2018 Outstanding Self-financed Students Abroad Award. Her research achievements have attracted international media attention, including coverage by CNN, Herald Sun (Australia), and Nikkan Kogyo Shimbun (Japan). Her research interests include electronic skins, hydrogel bioelectronics, human-machine interfaces, and diagnostics and therapeutics.

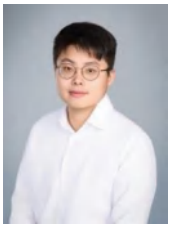
Title: Electronic Skins for Continuous Health Monitoring

Abstract: One limitation of commercial wearables, such as smartwatches and fitness bands, is their inability to establish conformable contact with human skin due to their rigid form factors, which restrict their monitoring capabilities. In contrast, soft bioelectronics offer a promising platform for personalized health care, thanks to their unique attributes, including thinness, lightweight design, excellent biocompatibility, mechanical robustness, and superior skin conformability. Permeable, skin-mountable electronics designed for long-term use have emerged as powerful tools for early disease prevention, screening, diagnosis, and treatment. Dr. Wang ' s research primarily focuses on the development of unconventional soft materials for advanced electronic skins. In today' s presentation, Dr. Wang will discuss high-performance electronic skins created using intrinsically stretchable materials, such as nanomeshes and hydrogels, for continuous health monitoring. These innovations enable precise measurement of various electrophysiological signals without compromising comfort, accuracy, or stability, supporting long-term health monitoring applications.

Invited Speaker

14:10-14:30

Shichao Ding



Westlake University

Bio: Dr. Shichao Ding is an Assistant Professor at Westlake University since Jan 2026. He finished postdoctoral research at University of California San Diego (2022.06-2026.01) and worked with distinguished professor Joseph Wang. He received his M.S. degree from Northwestern Polytechnical University in 2018 and Ph.D. degree from Washington State University (PI: Prof. Yuehe Lin) in 2022, respectively. His research most focused on wearable electronics for autonomous healthcare.

Title: Biomolecular Monitoring: From Centralized Lab Assays to Self-Testing and On-Body Autonomous Monitoring

Abstract: The detection of nutrients, key disease biomarkers, drug molecules, and toxins in the human body is critically important for healthcare and diagnostics. Our research initially focuses on enhancing the sensitivity of immunosorbent assays (ELISA) through signal amplification strategies leveraging single atom nanozymes (SANs). These SANs exhibit exceptional stability under varying pH and temperature conditions, surpassing natural enzymes in robustness. Their superior catalytic specificity for hydrogen peroxide allows them to replace natural peroxidases, enabling highly sensitive biosensing. Building on this foundation, we have expanded SANs applications to electrochemical platforms for rapid, high-sensitivity detection and lateral-flow immunoassays for portable human biofluid diagnostics. Addressing the increasing demand for continuous, comfortable, and automated health monitoring, we further integrated wearable energy management modules and sensors into wearable microgrid systems. This advancement delivers practical, autonomous, and flexible solutions for self-powered energy management and extended healthcare monitoring.

Invited Speaker

14:30-14:50

Xiaojing Mu

Chongqing University

Bio: Xiaojing Mu is currently a professor at Chongqing University in China. he received his Ph.D. degree in Micro-Electro-Mechanical Systems (MEMS) from the National University of Singapore's School of Mechanical Engineering in 2013. He subsequently conducted research on micro-nano sensing and functional devices at the Institute of Microelectronics under the Agency for Science, Technology and Research in Singapore. In 2015, he was awarded the title of professor by Chongqing University. His research field covers micro-nano electronic science and technology, and specifically focusing on application research for trace substance detection based on micro-nano metasurfaces.

Prof. Mu has published 2 scientific monographs, more than 100 peer-reviewed papers (Advanced Materials, Advanced Science, ACS Nano, etc.), and contributed over 50

conference talks (MEMS, TRANSDUCERS, and NEMS). He holds more than 20 authorized invention patents. In recognition for his research accomplishments, Prof. Mu has received 7 academic awards. Currently, he serves as the Vice Chairman of the Chongqing Acoustical Society and as a Council Member of the Sensor Division of the China Instrument and Control Society. Additionally, he is the Editor-in-Chief of Sensors International, a member of the Editorial Board for Piezoelectrics & Acoustooptics, and a Guest Editor for special issues of Sensors.

Title: Advance in Metamaterials Sensor and AI for Metamaterials

Abstract: Metamaterials present innovative approaches for the highly sensitive detection of molecules through the precise control of electromagnetic resonance. This paper outlines recent advancements in metamaterial-based biosensors, which have achieved high-sensitivity detection of molecules such as biotin and miR-155 by employing structural designs that facilitate local field enhancement and strong coupling with molecular vibrations. Additionally, we introduce a metamaterial platform for gas detection that integrates metal-organic frameworks with differential amplification strategies under coupled modes, enabling on-chip detection and highly sensitive responses to CO2 and CH4. In the realm of chemical sensing, multi-fingerprint recognition and trace pesticide residue detection have been accomplished using multi-resonator absorbers and an overcoupled design. Finally, we investigate the applications of artificial intelligence in metamaterial inverse design and spectral analysis, which facilitate enhanced viral fingerprinting, precise identification of 13 molecules, and intelligent analysis of complex mixtures. These advancements lay a technological foundation for the development of highly sensitive sensing systems tailored for complex environments.

Invited Speaker

14:50-15:10

Ying Jiang

University of Macau

Bio: Ying Jiang is currently an Assistant Professor and Principal Investigator at the University of Macau. She received her BS degree from Sun Yat-Sen University and MS degree from Tsinghua University (Supervisor: Prof. Jiaping Wang). She then completed her PhD and postdoctoral research at Nanyang Technological University, Singapore (Supervisor: Prof. Xiaodong Chen), following by a visiting postdoctoral fellowship at Stanford University (Supervisor: Prof. Zhenan Bao).

Dr. Jiang's research focuses on system-level integration of soft bioelectronic systems. So far, she has published over 30 high profiled articles including Nature (first author), Nature Electronics, Nature Communications, Advanced Materials, and so on. Dr. Jiang has been a recipient of prestigious awards including the Tsinghua University Graduate National Scholarship and the National Award for Outstanding Self-Financed International Students.

Title: Integration of Soft Bioelectronic Devices

Abstract: Soft electronics capable of conformal and seamless integration with soft biological tissues enable stable bidirectional interactions at human – machine interfaces, promising for applications such as

implantable neuromodulation, wearable electronic skin, and soft robotics. Current soft electronic systems are typically hybrid architectures composed of soft modules, rigid modules, and encapsulation modules; therefore, the mechanical robustness of individual modules as well as the interconnects are both critical to overall system performance.

This talk begins by introducing soft functional modules based on auxetic mechanical metamaterials, which provide tunable Poisson’s ratios and enable distinctive sensing capabilities in soft strain sensors. It then highlights the development of a unique biphasic nanostructure (BIND) interface, which enables reliable electrical and mechanical connections among various modules through a simple press-to-connect strategy. By using this BIND interconnect, complex hybrid soft electronic systems, including implantable neuro-electrodes and on-skin electrophysiological devices, can be reliably assembled in a modular, Lego-like manner.

Technical Sessions

D3-PM-A07: Micro Biosensing and Micro Manipulation & Milli Micro and Nano Robotics

13:30-15:30, April 19, 2026 **Meeting Room 306**

Session Chair: Chia-Hung Chen, City University of Hong Kong

Keynote Speaker

13:30-14:00

Guo Zhan Lum

Nanyang Technological University

Bio: Guo Zhan Lum received his B.Eng. with first class honors in mechanical engineering from Nanyang Technological University in 2010. He went on to pursue his postgraduate studies in mechanical engineering under the dual Ph.D. program of Nanyang Technological University and Carnegie Mellon University. He received his M.Sc. degree from Carnegie Mellon University in 2015, and dual Ph.D. degrees in 2016. From 2016 to 2017, he was a post-doctoral researcher at the Max Planck Institute for Intelligent Systems. Since 2018, he is a faculty member in Nanyang Technological University and he is currently a tenured Associate Professor. To date, he has published twenty journal papers, including multi-disciplinary journals such as Nature (1x), PNAS (1x), Advanced Materials (6x) and Science Advances (1x). Several of his works have been featured as the Front Cover, Inside Back Cover and Frontispiece for Advanced Materials too. His works on magnetic miniature robots, soft robots, and highly reversible and switchable adhesives have been reported by more than 130 international media, including but not limited to The BBC, The New York Times and The Wall Street Journal. His Nature paper with Professor Sitti has also been awarded the prestigious 2025 Frontiers of Science Award.

Title: Highly Functional Miniature Soft Robots: Towards Transformative Medicine

Abstract: Magnetic miniature robots (MMRs) are small-scale, untethered actuators which can be controlled by magnetic fields. As these actuators can non-invasively access highly confined and enclosed spaces, they have great potential to revolutionize numerous applications in robotics, materials science and biomedicine. While the creation of MMRs with six-degrees-of-freedom (six-DOF) represents a major advancement for this class of actuators, these robots are not widely adopted due to two critical limitations: (i) under precise orientation control, these MMRs have slow sixth-DOF angular velocities (4 degree/second) and it is difficult to apply desired magnetic forces on them; (ii) such MMRs cannot perform soft-bodied functionalities. Here we introduce a fabrication method that can magnetize optimal MMRs to produce 51 – 297 folds larger sixth-DOF torque than existing small-scale, magnetic actuators. We also propose a universal actuation method that is applicable for rigid and soft MMRs with six-DOF. Under precise orientation control, our optimal MMRs could execute full six-DOF motions reliably and achieve sixth-DOF angular velocities of 173 degree/second. Our soft MMRs could display unprecedented

functionalities; our six-DOF jellyfish-like robot could swim across barriers impassable by existing similar devices and our six-DOF gripper was 20 folds quicker than its five-DOF predecessor in completing a complicated, small-scale assembly. We had also created a soft MMR which can dispense four types of drugs with reprogrammable drug-dispensing sequence and dosage. This six-DOF MMR has great potential to enable advanced targeted combination therapy, where four types of drugs must be delivered to various disease sites, each with a specific sequence and dosage of drugs. This MMR has great prospects to transform targeted combination therapy since it can realize significantly higher efficacy than those demonstrated by existing treatments.

Keynote Speaker

14:00-14:30

Chia-Hung Chen

City Univeristy of Hong Kong

Bio: Prof. Chia-Hung Chen is an internationally recognized expert in microfluidic biosensors and an Associate Professor of Biomedical Engineering at City University of Hong Kong (Professor from July 2026). He has been recognized among the world's top 2% most-cited scientists by Stanford University. Prof. Chen received his Ph.D. from the University of Cambridge and completed his postdoctoral training at the Massachusetts Institute of Technology (MIT). His research focuses on soft systems and high-throughput microfluidic technologies for analyzing cellular heterogeneity in human health and disease. By integrating microfluidic engineering with single-cell micro/nano-technologies, he develops innovative platforms that advance diagnostics and therapeutic strategies for complex diseases, including cancer, infectious diseases, and autoimmune disorders, supporting the development of precision medicine. As a principal investigator, he has secured more than 25 internationally competitive research grants. He also serves on the editorial boards of journals including Biomicrofluidics and IEEE publications. His work spans microfluidic systems, biosensors, and single-cell technologies, driving transformative advances in biomedical research.

Title: High-Throughput and Sensitive Metabolic Analysis Using Membrane-Anchored Molecular Sensors on Mother Yeast Cells (MOMS)

Abstract: Yeast, owing to its genetic similarity to humans, is a key model organism for studying fundamental biological processes such as cell division and metabolism in life sciences and drug discovery. However, existing tools for measuring extracellular secretion lack the sensitivity and throughput required for large-scale metabolic analysis. Here, we present MOMS (Molecular Sensors on the Membrane Surface of Mother Yeast Cells) for ultrasensitive single-cell secretion analysis. These sensors are selectively anchored to mother yeast cells and remain confined during budding, enabling stable single-cell assays. MOMS achieve a 100 nM detection limit and screen >10^7 cells per run, providing >30-fold faster screening than droplet methods and enabling rapid identification of rare secretory strains.

Invited Speaker

14:30-14:50

Qili Zhao

Nankai University

Bio: Qili Zhao (Member, IEEE) received his Ph.D. degree in control theory and control engineering from Nankai University, Tianjin, China, in 2014. He was a Post-Doctoral Researcher with the Robotics and Mechatronics Research Laboratory, Department of Mechanical and Aerospace Engineering, Monash University, Melbourne, VIC, Australia, from 2014 to 2015. He was a Post-Doctoral Fellow with the Advanced Micro and Nanosystems Laboratory, Department of Mechanical and Industrial Engineer ing, Toronto University, Toronto, ON, Canada, from 2015 to 2018. He is currently an Associate Professor with the College of Artificial Intelligence, Nankai University. His research interests include robotic patch clamp, robotic cell manipulation, and robotic cell measurement. He has published 24 SCI papers including 1 Science Robotics paper and 12 IEEE Transactions papers as the first author or corresponding author. He has hosted more 10 grants with funding more than ￥4000000.

Title: Robotic Patch Clamp Techniques for Brain Science Research

Abstract: The patch clamp technique has been recognized as the “gold standard” of ion channel research due to its capability to detect the picoampere level (10-12A) current flowing through single ion channels. The current manual patch clamp techniques has complicated procedures, high expertise requirement and poor repeatability, significantly limiting its wide application in brain science research. Addressing these, out group has developed the first robotic patch clamp system for brain science research in China. Based on this robotic system, the precise whole-cell patch clamp technique based on 3D cell morphology measurement, stable and tight gigaseal driven by voltage and pressure, quantitative break-in method based on active release control of perforating materials, and balanced stripping method of aspirated membrane were realized for the first time. The above research significantly improves the operation success rate of patch clamp operation, prolongs the recording duration of neuron signals, and conducted high-efficiency stripping of square micrometer-level cell membrane patch. At present, robotic patch clamp experiments on more than 600 adherent cells, 3000 neuron cells in 1200 mouse brain slice, 156 neurons in 125 mice brains, 186 neurons of 17 rat brains, 75 neurons of 15 marmoset brains have been operated by our robotic patch clamp system. The first patch clamp recording of electrophysiological signals of awaken non-human primates. The above system and technologies have been applied in multiple domestic top research groups in brain science, significantly lowering down technique threshold of brain science research and promoting the application of patch clamp technique.

Invited Speaker

14:50-15:10 **Yifan Wang**

Nanyang Technological University

Bio: Prof. Wang Yifan is the Nanyang Assistant Professor at School of Mechanical and Aerospace Engineering, Nanyang Technological University Singapore, where he leads the "Robotic Materials" Group. Prof. Wang received his Ph.D. in Soft Matter Physics from The University of Chicago, USA (2016), and B.S. in Physics from Peking University, China (2011). Prior to joining Nanyang Technological University in 2020, Dr. Wang worked as a postdoctoral fellow in Department of Mechanical and Civil Engineering at California Institute of Technology, USA. Prof. Wang is an innovative applied physicist and mechanical engineer with extensive experience on soft robotics, human-machine interfaces, and advanced manufacturing. He has published papers in top international journals, including Nature, Science Robotics, Science Advances, Advanced Materials, Physical Review Letters, Matter, Advanced Functional Materials, etc. He is the associate editor of Mechanics of Materials journal, and have won numerous awards including the Healthy Longevity Global Grand Challenge Catalyst Award, Nanyang Assistant Professorship Award, Grainger Foundation Graduate Fellowship in Experimental Physics, etc.

Title: Multichannel Muscle Impedance Sensing for Collaborative Human – Machine Interfaces

Abstract: The rapid development of collaborative human – machine systems has created an urgent need for reliable and comprehensive sensing of muscle states. Existing approaches often detect only active muscle signals or are vulnerable to motion-related disturbances, limiting their effectiveness in real-world applications. In this seminar, I will present a flexible, noninvasive sensing platform designed to accurately monitor muscle contraction states, including both active and passive conditions. By leveraging impedance-based sensing in a soft, skin-conformal format, the system enables stable, multi-site monitoring with reduced motion artifacts. This approach provides a robust interface between the human body and machines, offering new opportunities for intuitive control, assistive robotics, rehabilitation technologies, and next-generation wearable systems.

Invited Speaker

15:10-15:30 **Fangbo Qin**

Laboratory of Brain Atlas and Brain-Inspired Intelligence, Institute of Automation, Chinese Academy of Sciences

Bio: Fangbo Qin is currently an Associate Professor at the Brain-AI Lab, Institute of Automation, Chinese Academy of Sciences (CASIA). He received the Ph.D. degree in control theory and control engineering from CASIA in 2019. He worked as an Assistant Professor at the Center of Precision Sensing and Control from 2019 to 2022, then joined Brain-AI Lab since 2022. His research field covers the BCI implantation robot, intelligent vision, and high-precision manipulation. He have published over 30 papers on

journals/conferences including IEEE Transactions, RA-L, ICRA, IROS, ECCV, and ICCV. He led the development of the first automated FME array implantation robot CyberSense in China, which successfully fulfilled the brain cortex implantation on live macaque and was deployed at Shenzhen Brain Science Infrastructure.

Title: Robotic Implantation of BCI Flexible Microelectrode Array

Abstract: Flexible microelectrode (FME) array based implantable brain-computer interface (BCI) is a cutting-edge frontier in recent years. Compared to other BCI paradigms, FME offers the unique advantages in signal richness and long-term biocompatibility, supporting applications such as thought control for the disabled, visual restoration for the blind, and animal-based neuroscience research. To achieve high-throughput neural recording, multiple fiber-like FME probes are precisely implanted into the cerebral cortex without damaging critical blood vessels — a task that requires a robot with intelligent microscopic vision and high-precision control. This report reviews the evolution of FME implantation and presents the key technologies and application results of our self-developed implantation robot CyberSense.

Technical Sessions

D3-PM-A08: Micro/Nano Energy Devices and Self-Powered Systems

13:30-15:00, April 19, 2026 **Meeting Room 307**

Session Chair: Zhen Wen, Soochow University

Keynote Speaker

13:30-14:00 **Jianfeng Zang**

Huazhong University of Science and Technology

Bio: Professor Jianfeng Zang is Chief Professor of the Huazhong Distinguished Scholar Program, and Director of Advanced Medical Devices Lab, in School of Integrated Circuits, Huazhong University of Science and Technology. He has been appointed as a Chang Jiang Scholars Distinguished Professor by the Ministry of Education and was selected for the Young Talents Program of the Overseas High-Level Talent Initiative. His research focuses on intelligent soft materials and innovative medical devices at the intersection of medicine and engineering. He has received the Hubei Provincial Natural Science Award (Second Class) and the 2023 Scientist Medal from the International Association of Advanced Materials. He is also a Fellow of the Royal Society of Chemistry (FRSC). With over 90 publications in prestigious journals such as Nature, Nature Biomedical Engineering, and Science Robotics, he holds more than 30 authorized invention patents. Several patents have been licensed by companies. Professor Zang has led several major research projects, including the NSFC Original Exploration Program Project and the National Key R&D Program of China. His research achievements have been recognized in several notable lists, including "Chip 2024 Top 10 Advances in Chip Science in China", "2024 Top 10 Advances in Medical-Engineering Integration and Technological Innovation in China", "Huanao—2024 Top 10 Advances in Brain-Computer Interface in China", "2024 Top 10 Scientific and Technological Advances in Hubei Province".

Title: Implantable Soft Acoustic Hydrogels for Ultrasound Sensors on Monitoring Physiological Signals

Abstract: Recent advances in soft materials, robotics, and manufacturing technologies have inspired many innovations in biomedical engineering like wearable electronics, implantable sensors, and new intervention methods. Soft acoustic materials possess extraordinary acoustic properties for long-distance wireless sensing and communication without the addition of electronic components or metal electrodes. To address the grand challenges in understanding the interfaces between human and medical devices, I will show our recent progress in the development of the medical devices using soft acoustic hydrogels. Examples will be involved in this talk include: metagel ultrasonic sensor for wireless monitoring of physiological signals like strain, pressure, temperature, pH. Achieving multimodal and decoupled physiological signals is beneficial for an intricate and precise depiction of bodily health. Besides, wireless

sensor in the form of embedded ultrasonic soft sensors (EUSS) is integrated with miniature machine, magnetic actuators, to address sensing-actuation incompatibility, enabling precise robotic feedback control, drug dosing, and physiological monitoring in vivo.

Keynote Speaker

14:00-14:30

Linwei Yu

Nanjing University

Bio: Prof. Linwei Yu is a full professor and doctoral supervisor at the School of Electronic Science and Engineering, Nanjing University. He is the recipient of the National Science Fund for Distinguished Young Scholars and has been supported by multiple prestigious talent programs, including the National High-Level Overseas Talent Program (Youth), the Jiangsu Provincial Innovation and Entrepreneurship Talent and Team Program, and the Jiangsu Outstanding Youth Foundation.

Prof. Yu received his B.Sc. in Physics from Nanjing University in 2001 and his Ph.D. in Solid-State Electronics and Microelectronics from the same university in 2007. He then conducted postdoctoral research at École Polytechnique (LPICM) in France before joining the French National Center for Scientific Research (CNRS) as a tenured researcher. Since 2013, he has been with Nanjing University.

His research focuses on the additive manufacturing of silicon-based nanostructures, growth mechanisms, three-dimensional integration, and high-performance device applications. He has published over 130 papers in leading journals, including Physical Review Letters, Science Advances, Nature Communications, Nano Letters, ACS Nano, Advanced Materials, and Advanced Functional Materials. He holds more than 40 Chinese patents and three PCT patents, and has led major national and industrial projects, including collaborations with Huawei Terminal, HiSilicon, and BOE.

Title: High-Performance Logic, Sensor, and NEMS Applications Using Geometrically Programmable Silicon Nanowires

Invited Speaker

14:30-14:50

Longbiao Huang

Shenzhen University

Bio: Long-Biao Huang is currently a Professor and Doctoral Supervisor at the College of Physics and Optoelectronic Engineering, Shenzhen University, holding titles of High-Level Overseas Talent and Shenzhen High-Level Talent. Prof. Huang obtained his B.Sc. and M.Sc. degrees from Xi’ an Jiaotong University, and then went to Global R&D Center of Dow Chemical as Research Chemist. In 2014, he obtained his Ph.D. degree from Center of Super-Diamond and Advanced Films, City University of Hong Kong. His research focuses on the processing, preparation, and application of functional polymer materials.

Prof.Huang has published over 100 papers in relevant fields, including Advanced Materials, Advanced Energy Materials, Advanced Functional Materials, and Science Bulletin. He has also led multiple research projects funded by the National Natural Science Foundation of China, the Natural Science Foundation of Guangdong Province, and the Shenzhen Municipal Science and Technology Innovation Commission.

Title: Applications of Functional Polymers in Self-Powered Sensors

Abstract: Flexible sensors that can detect the impact of the external environment and provide corresponding feedback are widely used in smart wearable devices. Based on the working principles, sensors can mainly be divided into capacitive, resistive, piezoelectric, and triboelectric types. Among them, triboelectric sensors do not rely on an external power supply and can convert mechanical energy into electrical signals. They also offer advantages such as material versatility, simple manufacturing processes, designable structures, and low cost, making them widely applicable in health monitoring, biomedical applications, human-machine interfaces, and soft robots. However, when using self-powered sensors, the devices may be affected by mechanical forces, harsh environments, or deformation. Unpredicted damage or performance loss of self-powered sensors could be induced by the interface friction between different materials and frequent mechanical deformation. Self-healing polymer as smart materials have presented a preferred strategy to solve above problems. By applying these materials to the triboelectric layers and electrode layers of self-powered sensors, the device's lifespan can be significantly extended, enhancing safety and reliability. In recent years, a series of flexible self-healing self-powered sensors have been designed and fabricated by focusing on the design and preparation of functional polymer materials, which is in favor of the development of future sustainable and flexible sensing technology.

Invited Speaker

14:50-15:10

Chunfeng Wang

Shenzhen University

Bio: Chunfeng Wang is a research Professor and Ph.D. supervisor at the College of Materials Science and Engineering, Shenzhen University. He received his B.S. (2013) and Ph.D. (2019) degrees from the School of Materials Science and Engineering, Zhengzhou University. During his Ph.D., he was jointly trained at the University of California, San Diego (as a CSC visiting scholar) and the Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences. His research focuses on mechanoluminescent materials and tactile sensing devices.He has published more than 60 papers in high-impact journals such as Nature Nanotechnology, Advanced Materials, Advanced Functional Materials, ACS Nano, and Science Bulletin, including 16 ESI highly cited papers and 4 hot papers, with over 9000 total citations and an H-index of 42. His honors include the Nanoscale 2025 Emerging Investigator by the Royal Society of Chemistry, First Prize in Natural Science of Henan Province (8/9), Shenzhen High-Level Overseas Talent Award. He serves as a youth editorial board member for Exploration, Soft Science, Wearable Electronics, Nano-Micro Letters, Information & Functional Materials, and Progress in Natural Science: Materials

International.

Title: Mechanoluminescent Materials for Tactile Sensor

Abstract: Touch provides access to information in areas where other senses fall short, making it essential for perceiving complex physical properties. Tactile sensors, which mimic the touching functions of human skin, are foundational to intelligent perception and play a critical role in robotics, smart manufacturing, prosthetics, and human – machine interaction. Mechanoluminescence (ML) is a direct force-to-light conversion phenomenon in which materials emit light under mechanical stimulation, without the need for external electric fields or light sources. Its strong correlation with mechanical stress makes ML highly suitable for self-powered, multimodal optical tactile sensors. Our research focuses on mechanoluminescent materials and their integration into tactile sensing devices. Specifically: (1) We design and synthesize heterojunction mechanoluminescent materials, revealing the relationship between heterointerfaces and luminescence performance, thereby addressing the challenges of weak emission intensity and limited wavelength range; (2) We develop mechanoluminescence-based tactile sensors, investigating the coupled force – electric – optical responses to achieve self-powered, visual, high-resolution, interference-free, and real-time sensing and imaging of complex tactile information; (3) We establish advanced techniques for dynamic optical signal acquisition, enabling accurate, interference-free recognition and reconstruction of mechanoluminescent signals, and laying the groundwork for intelligent mechanoluminescent sensing and interactive systems.

Invited Speaker

15:10-15:30

Kai Dong

Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences

Bio: Prof. Kai Dong is a research fellow and doctoral supervisor in Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences. He is also the head of the Smart Textile Lab, Beijing Overseas High-Level Talents, Beijing Special Expert, and Visting Scholar at Georgia Institute of Technology. His research interests mainly focus on new mechano-electric conversion fiber materials and self-powered wearable textile devices based on contact or frictional electrification effects, including the contact electrification mechanism of polymer dielectrics, performance optimization of mechano-electric conversion fiber materials, and integrated applications of self-powered wearable textile devices. He has published more than 100 papers, including Nat. Commun., Sci. Adv., Adv. Mater., and etc. In addition, he has won the International Advanced Materials Society Scientist Award, the 2023 Clarivate Analytics Interdisciplinary Highly Cited Researchers, and the 2023 Elsevier Highly Cited Chinese Researchers.

Title: Triboelectric Fibers and Self-Powered Wearable Devices

Abstract: Triboelectric fiber materials represent a novel integration of an emerging mechanical energy harvesting technology—triboelectric nanogenerators—with traditional textile materials. To address key scientific and technical challenges such as unclear charge generation mechanisms, insufficient electrical output performance, limited self-powered sensing accuracy, and a narrow range of smart application scenarios, this study systematically investigates the triboelectric/contact electrification mechanism. Through surface/interface material modification, interfacial microstructure regulation, and three-dimensional fabric structural design, the output power density and pressure sensing performance of the fiber materials have been effectively enhanced. Furthermore, by integrating circuit management, program development, and interface design, the application of these materials has been explored across various fields, including wearable self-charging power-generating textiles, complex human motion recognition, underwater ultrasonic positioning and tracking, physiological signal monitoring and personalized health diagnostics, intelligent security systems, and human–machine interaction devices. Efforts are also being made to advance the industrial application of triboelectric fiber materials.

Technical Sessions

D3-PM-A09: Nanodevice Physics

13:30-15:10, April 19, 2026 **Meeting Room 308**

Session Chair: Ting Wen, Huzhou College

Invited Speaker

13:30-13:50 **Zhiwen Shi**

Shanghai Jiao Tong University

Bio: Zhiwen Shi is currently a Professor at the School of Physics and Astronomy, Shanghai Jiao Tong University (SJTU). He received his Bachelor of Science degree from the University of Science and Technology of China (USTC) in 2007. He went on to obtain his Ph.D. from the Institute of Physics, Chinese Academy of Sciences in 2012. He worked as a postdoctoral researcher in the Department of Physics at the University of California, Berkeley, from 2012 to 2016. In 2016, Dr. Shi joined the faculty at Shanghai Jiao Tong University. His research group focuses on experimental condensed matter physics, with a particular emphasis on the optical and electrical properties of low-dimensional quantum materials.

Prof. Shi has published over 90 papers in top-tier academic journals such as Nature and Science, with 13 of his publications recognized as ESI Highly Cited Papers, and a total citation of more than 12,000. He was selected for the National Recruitment Program of Global Experts (Youth Program) and has received the National Natural Science Foundation of China (NSFC) Young Scientists Fund (Class A).

Title: Low-dimensional Carbon Materials for High-performance Nanoelectronics

Abstract: Graphene has excellent electrical transport properties, yet it cannot be used to construct transistor devices due to the lack of an energy gap. Theoretically, quasi-one-dimensional graphene nanoribbons and carbon nanotubes can open an energy gap by quantum confinement effects, and the size of the energy gap can be controlled by structure, making them ideal candidates for constructing high-performance electronic devices. In this talk, I will introduce a new method for directly growing high-quality low-dimensional carbon materials on insulating substrates. Based on this method, we have achieved: (1) embedded growth of graphene nanoribbons between boron nitride atomic layers to form an "in-situ encapsulated" graphene nanoribbon structure; (2) direct growth of homochiral and close-packed carbon nanotube arrays to form carbon nanotube van der Waals crystals. In addition, I will also introduce our exploration of the material growth mechanism, as well as the excellent performance of field-effect transistor devices constructed based on these low-dimensional carbon materials.

Invited Speaker

13:50-14:10

Xiaoxiang Xi

Nanjing University

Bio: Xiaoxiang Xi received his PhD in 2011 at University of Florida, USA. Prior to joining Nanjing University in 2016, he was a postdoctoral research associate at Brookhaven National Laboratory and Pennsylvania State University. His current research interest is the exploration of emergent phenomena in low-dimensional quantum materials using advanced optical spectroscopy.

Title: Gate Tuning of Excitonic Insulator Candidate Ta2NiSe5

Abstract: Realizing an excitonic insulator phase from narrow-gap semiconductors remains challenging, as unambiguous experimental signatures are difficult to establish. Ta2NiSe5 has been widely regarded as a leading candidate, yet the nature of its phase transition and insulating state remains controversial. In this talk, I will discuss a systematic Raman spectroscopy study of Ta2NiSe5 as a function of thickness and field-effect doping, complemented by electrical transport measurements. The phase transition persists down to the monolayer limit, with the critical temperature increasing as thickness decreases. In bilayer samples, both electron and hole doping suppress the insulating state, with electron doping lowering and hole doping raising the transition temperature. Importantly, the quasi-elastic scattering, previously attributed to excitonic fluctuations, evolves monotonically across the entire doping range, inconsistent with the expected suppression of excitonic correlations by Coulomb screening. These findings rule out a dominant excitonic mechanism and instead point to a coupled electronic and structural phase transition, whose stability is tunable by carrier doping. Our doping-based approach offers a general strategy for evaluating the role of excitonic effects in candidate excitonic insulators.

Invited Speaker

14:10-14:30

Junxiong Hu

University of Electronic Science and Technology of China

Bio: Hu Junxiong, Professor at the School of Physics, University of Electronic Science and Technology of China (UESTC), and a recipient of the National Youth Talent Award. He obtained his PhD from the National University of Singapore (NUS) in 2021 and subsequently worked as a Senior Postdoctoral Fellow. In 2024, he was honored with the National Youth Talent Grant and joined UESTC full-time. His primary research focuses on novel information materials and devices, with particular emphasis on emerging information devices such as magnetic detection, magnetic sensing, and spin transport. To date, he has published over 15 papers as corresponding author or first author in high-impact international journals, including Nature Materials, Nature Nanotechnology, and Nature Communications. His works have been cited as representative contributions in the field by top-tier academic publications such as Nature. As the sole Principal Investigator (PI), he has secured funding from the Ministry of Education (MOE) Tier 1

Academic Research Fund and the National Youth Independent Research Fund (YIRG) in Singapore. He has received numerous accolades, including the IEEE Magnetism Society Gold Award in Singapore, the NUS Graduate Student Excellence Award, the Materials Research Society Singapore Gold Medal, and the NUS Physics Breakthrough Award.

Title: Emergent Phenomena in Graphene Super-Moiré Lattice

Abstract: In the realm of materials, there are moiré patterns, and then there are super-moiré patterns. Moiré patterns are common, but super-moiré patterns are rare. Traditional moiré superlattices primarily feature a single moiré pattern. However, when two moiré patterns interact at an interface, they can give rise to a new structure known as a super-moiré lattice. Compared to conventional single moiré systems, this super-moiré structure expands the tunable dimensions of moiré quantum materials and is regarded as the "next generation of moiré quantum materials." In this presentation, I will discuss the novel and unique physical properties of graphene super-moiré, including exotic magnetotransport behavior in quantum critical states and linear temperature dependence induced by electron-phonon coupling. Finally, I will explore the realization of topological flat bands in monolayer graphene using super-moiré structures and the potential for strongly correlated states.

Invited Speaker

14:30-14:50

Xia Liu

Beijing Institute of Technology

Bio: Dr. Xia Liu received her Ph.D. degree in Institute of Microelectronics at Tsinghua University in 2017. From 2012 to 2013, she was a visiting student in University of California at Berkeley. From 2017 to 2018, Dr. Liu was entitled as a Wen H. Ko Fellow at Case Western Reverse University, USA. From 2018 to 2023, she was a researcher scientist in Microsystems laboratory, EPFL. Currently, she is a professor in Beijing Institute of Technology. Her current research interest is focused on advanced micro/nanofabrication, thermal scanning probe lithography, strain engineering, 2D materials, electronic nanodevices and sensing applications.

Title: High-Resolution and Grayscale Nanopatterning Using Thermal Scanning Probe Lithography

Abstract: Due to the functional requirements of micro-/nanoscale devices, there is a growing need for structurally complex micro-nano architectures with high spatial resolution and tunable depth profiles. Despite this need, traditional binary lithography can only create structures with uniform depth in photoresist, making it challenging to fabricate more complex three-dimensional (3D) structures. In contrast, grayscale lithography enables regional dose modulation of light, electron, or ion, thereby forming precise 3D grayscale structures with continuous height profiles in photoresist. We developed a new nanoengineering approach to induce deterministic strain in atomically thin MoS2 through topographic grayscale nanopatterning of the gate dielectric. Monolayer MoS2 FET under 1% tensile strain shows an 8-fold increase in on-state current and electron mobility of up to 185 cm^2 /Vs. We also developed a probe-guided laser direct writing (PG-LDW) approach for grayscale patterning directly on 2D material films with 0.2nm vertical resolution.

Invited Speaker

14:50-15:10

Luda Wang

Peking University

Bio: Prof. Luda Wang is currently working at School of Integrated Circuits and Academy for Advanced Interdisciplinary Studies at Peking University. He received the Ph.D. degree in Mechanical Engineering from University of Colorado, Boulder in 2014. And then he joined Massachusetts Institute of Technology (MIT) as a postdoc researcher. His research field focuses on mass transport in confined space, micro/nano sensors, two-dimensional separation membranes and iontronics.

Prof. Wang has published more than 50 peer-reviewed papers (Nature materials, Nature Nanotechnology, Advanced Materials, ACS Nano, etc.), and contributed multiple conference talks (MRS, μFIP, APCOT, ICSICT, etc.). He also served as referee for several highly-reputable journals (Nature Sustainability, Nature Communications, PNAS, Advanced Materials, ACS Nano, Nano letters, etc.).

Title: An Ångström-Scale Janus Aperture as a Gas Flow Rectifier

Abstract: Directional transport of matter, charge, and energy at the nanoscale is of fundamental importance and underpins numerous technologies, exemplified by the electronic diode that forms the backbone of modern integrated circuits. In nature, biological ion channels achieve exquisite rectification of ionic flows through asymmetric structures, inspiring artificial ionic diodes with rectification ratios up to 104 for applications in separation, sensing, and energy conversion. However, rectifying charge-neutral molecular flows−such as gases−remains a formidable challenge because their transport is governed by weak, short-range van der Waals interactions rather than Coulomb forces, offering limited handles for external control. Here we explore gas transport through an ångström-sized Janus aperture in graphene, which is created by feedback-controlled ozone etching and features oxygen-containing functional groups asymmetrically distributed around the edge. Ten representative gases with molecules of varying compositions, shapes and sizes were measured. The permeation coefficients indicate energy barrier-controlled transport. Rectified flow was consistently observed for seven different species including krypton, xenon, hydrogen, oxygen, nitrogen, carbon dioxide and nitrous oxide, with rectification ratios of up to two orders of magnitude for oxygen. Combined high-throughput density functional theory calculations and ab initio molecular dynamics simulations reveal the direction-dependent energy barriers originating from the asymmetric interactions between the gas molecules and the functionalized aperture edge, and the impact of the molecular polarizability on the rectified gas flow. Our work is of fundamental interest to broad communities especially in nanoscale transport, intermolecular interactions, low-dimensional materials.

Technical Sessions

D3-PM-A10: Micro/Nanoelectronic Materials and Devices

13:30-15:30, April 19, 2026 **Convention Hall A**

Session Chair: Zegao Wang, Sichuan University

Invited Speaker

13:30-13:50 **Yuda Zhao**

Zhejiang University

Bio: Dr. Zhao Yuda is ZJU100 Young Professor and doctoral supervisor. In 2012, he received a bachelor's degree from the School of Physics, Nanjing University. In 2016, he received his Ph.D. degree from the Department of Applied Physics, The Hong Kong Polytechnic University. Since 2016, he has successively engaged in post-doctoral research at the Hong Kong Polytechnic University and the University of Strasbourg (France). He was shortlisted for the 2017 Hong Kong Young Scientist Award and was awarded the individual fellowship under the EU Marie Skłodowska-Curie Actions. He joined the College of Integrated Circuits, Zhejiang University in 2020. His main research area includes high-performance logic devices and More than-Moore devices based on low-dimensional materials. At present, he has published more than 70 papers, among which 35 papers have been published in Nature Communications, Advanced Materials, and other journals as the first/corresponding author, and 2 papers are ESI highly cited papers. The research is highlighted by Nature Nanotechnology, Science China, and some press release websites.

Title: Silicon-Based Heterogeneous Integrated Infrared Detectors

Abstract: Near-infrared detection technology plays an irreplaceable role in applications such as optical communication, quantum communication, and spectral analysis. Although current mainstream III-V and II-VI compound semiconductor infrared detectors exhibit excellent detection performance, their widespread adoption is hindered by high costs and poor compatibility with silicon (Si) fabrication processes. This study proposes and demonstrates a novel integration scheme based on bonding with a semiconductor intermediate layer. By heterogeneously integrating Germanium (Ge) and Indium Gallium Arsenide (InGaAs) thin films onto Si substrates, high-performance Si-based short-wave infrared detectors were successfully fabricated.

The core of this approach lies in using amorphous or polycrystalline semiconductors as the bonding intermediate layer. During low-temperature bonding, this intermediate layer effectively buffers lattice mismatch, blocks dislocations from extending into the active region, and significantly improves the bonding strength at the heterogeneous interface. This results in Ge/Si and InGaAs/Si heterostructures with sharp interfaces and high crystalline quality. Based on these integrated materials, we developed corresponding Ge/Si and InGaAs/Si PIN and APD detectors. The devices demonstrate outstanding

performance in terms of sensitivity, operational bandwidth, and gain-bandwidth product, indicating significant potential for advanced applications such as high-speed optical communication and LiDAR. This bonding strategy offers strong process versatility and can be further extended to the heterogeneous integration of other wide-bandgap semiconductors with silicon platforms, providing a practical and feasible technological pathway for developing low-cost, high-performance silicon-based short-wave infrared detection chips.

Invited Speaker

13:50-14:10

Wei Xin

Northeast Normal University

Bio: Wei Xin is currently an associate professor and doctoral supervisor at Northeast Normal University (NENU), and has been selected as a Young Talent by the Ministry of Education, China. He received the Ph.D. degree in Nanophotonics from Nankai University in 2017, then conducted research at Zhejiang University, CIOMP (CAS), SITP (CAS), respectively. His main research areas include the photoelectric properties and micro-nano optoelectronic devices of two-dimensional materials and their heterostructures, femtosecond laser micro-nano processing, and the carrier dynamics of new semiconductor materials.

Professor Wei Xin has published over 70 papers in international journals such as Adv. Mater., Light Sci. Appl., and Nano Lett. He serves as a reviewer for renowned journals such as Nat. Commun. and Adv. Functi. Mater. He has applied for and been granted over 10 Chinese patents and has led or participated in multiple projects funded by the National Natural Science Foundation of China, the Ministry of Education, Jilin Province, and the Chinese Academy of Sciences.

Title: Performance and Mechanism Research of Two-dimensional Polarized Photodetectors

Abstract: The vector characteristics of light and the vectorial transformations during its transmission lay a foundation for polarized photodetection of objects, which broadens the applications of related detectors in complex environments. With the breakthrough of two-dimensional materials (2DMs) in optics and electronics over the past few years, the combination of these novel 2DMs and traditional working modes is expected to bring new development opportunities in this field. Here, the state-of-the-art progress of 2DMs, as polarization-sensitive components in polarized photodetection and even the imaging, is the main focus, with emphasis on the relationship between traditional working principle of polarized photodetectors (PPs) and photoresponse mechanisms of LDMs. Particularly, we introduced our work from the view of constitutive equations for the first time. Perspectives on the opportunities and challenges are also discussed. Our work can provide a more general overview in the use of 2DMs in this field, sorting out the way of related devices for “more than Moore” or even the “beyond Moore” research.

Invited Speaker

14:10-14:30

Weiwei Li

Nanjing University of Aeronautics and Astronautics

Bio: Prof. Li is a Professor in the College of Physics at Nanjing University of Aeronautics and Astronautics (NUAA). He received his PhD in multiferroic thin films from Soochow University. Before joining NUAA, he worked as a research associate at Prof. Judith Driscoll's group in the Department of Materials Science & Metallurgy at University of Cambridge. His group is mainly focused on the functional oxide thin films and their novel nanoelectronic devices such as non-volatile memory and dielectric energy storage. He has published over 100 journal articles including Science, Nature Electronics, Nature Communications, etc.

Title: Emergent Ferroic Materials and Devices Created by the Design of an Ordered Structure

Abstract: Complex transition-metal oxides (TMOs) are critical materials for cutting-edge electronics and energy-related technologies, on the basis of their intriguing properties including ferroelectricity, magnetism, superconductivity, (photo- and electro-) catalytic activity, ionic conductivity, etc. Ordered structure has emerged as a powerful tool to tailor the physical properties of TMOs. Here, using ordered structure such as oxygen vacancy, interface, etc, we demonstrate an emergent ferromagnetism and multiferroicity with magnetodielectric coupling in TMO epitaxial thin films. DFT calculations are further used to explore the underlying physics. Our work provides a new route to creating ferromagnetic-insulator and multiferroicity with magnetoelectric coupling in single-phase oxides using an ordered structure approach.

Invited Speaker

14:30-14:50

Wenjing Jie

Sichuan Normal University

Bio: Wenjing JIE is currently a Professor at Sichuan Normal University. Wenjing Jie obtained her BSc and MSc from the University of Electronic Science and Technology of China (UESTC). She received her PhD in Applied Physics from the Hong Kong Polytechnic University under the supervision of Prof. Jianhua Hao in 2015. She had her research assistant and then postdoctoral work in Prof. Hao's research group and continued the research mostly in electronic and optoelectronic devices based on 2D materials. His research field covers 2D materials, heterostructures, and their electronic and optoelectronic devices, and especially their applications for optoelectronic synaptic devices and neuromorphic computing. She has published more than 80 journal papers, including a first/corresponding authored paper in Advanced Functional Materials, ACS Nano, Nano Letters, Nano Energy with a total citation of more than 5000 times, H-index 40 (Google Scholar).

Title: Optoelectronic Synaptic Devices Based on 2D Layered Semiconductors and Ferroelectrics

Abstract: With the continuous development of information technology and artificial intelligence, optoelectronic synaptic devices with high bandwidth, low crosstalk, low power consumption and no latency not only have the advantages of simulating visual neural behavior, but also have broad application prospects in the fields of high-performance computing and artificial intelligence. 2D materials have drawn much attention for the applications in neuromorphic computing and artificial vision system owing to their unique electronic and optoelectronic properties. Recently, our research group reported some synaptic devices based on 2D materials. Synaptic memristors based on BiOI nanosheets exhibit bipolar resistive switching performance with a high on/off ratio up to 105 and an ultralow SET voltage of ~ 0.05 V. Furthermore, a novel multifunctional synaptic device based on ferroelectric In2Se3/GaSe vdW heterojunction is proposed to emulate the entire biological visual system. Moreover, we design ferroelectric tuned synaptic transistors by integrating 2D black phosphorus (BP) with a flexible ferroelectric copolymer poly(vinylidenefluoride-trifluoroethylene) (P(VDF-TrFE)), demonstrating a high mobility value of 900 cm2 V−1 s−1, high on/off current ratio of 103 and low energy consumption down to the femtojoule level (~ 40 fJ). Such optoelectronic synaptic devices based on 2D materials demonstrate potential applications in neuromorphic computing and retina-like vision sensors.

Invited Speaker

14:50-15:10

Junxiong Guo

Chengdu University

Bio: Junxiong Guo is currently a Distinguished Professor at Chengdu University. He received the Ph.D. degree in Microelectronics and Solid-State Electronics from University of Electronic Science and Technology of China (UESTC) in 2020. Then he joined the Department of Physics, School of Electronic Information and Electrical Engineering, and Institute for Advanced Study at Chengdu University, as an associate distinguished research scientist. He also served as a joint postdoctoral fellow at the University of Electronic Science and Technology of China and Chengdu Research Institute of UESTC from 2023 to 2025. His research interests focus on novel micro & nano device and integrated system based on low-dimensional materials and smart optoelectronic applications. Prof. Guo has published more than 30 peer-reviewed papers (Nature Communications, Nano Letters, Science China, IEEE EDL, IEEE Trans., etc.), 2 scientific book sections, and contributed over 10 conference talks, and authorized 13 invention patents. He also served as IEEE member, CIE Member and session chair for IEEE ICET 2025, and referee for several highly-reputable journals (Advanced Materials, Advanced Optical Materials, Information Sciences, etc.).

Title: Ferroelectric Metasurface

Abstract: Metasurfaces—two-dimensional arrays of subwavelength nanostructures—have revolutionized wavefront control and enabled diverse applications including compact flat lenses, polarizers, and holograms. However, the static nature of conventional metasurfaces limits their applicability in dynamic systems such as LiDAR, adaptive optics, and real-time sensing. Currently, most reconfigurability strategies

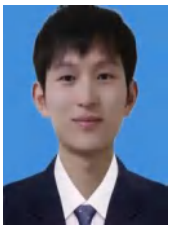
— relying on thermo-optic effects, carrier injection, or phase-change materials — exhibit high power consumption, slow switching speeds, and restricted modulation ranges. Here, we propose a ferroelectric metasurface concept, whose spectral response can be dynamically and non-volatilely controlled by reconfiguring the ferroelectric domains. This approach potentially enables low-power, high-speed, and broadband modulation, thereby establishing a pathway toward achieving ultra-compact, reconfigurable photonic systems for integrated sensing, communication, and computing applications.

Invited Speaker

15:10-15:30

Yu Liu

Nanjing Uniersity of Post and Telecommunication



Bio: Yu Liu is currently a Professor at the School of Integrated Circuits, Nanjing University of Posts and Telecommunications (NJUPT), China. He received the B.S. degree from the University of Electronic Science and Technology of China (UESTC) and the Ph.D. degree from the School of Integrated Circuits, Tsinghua University. His research interests focus on gallium oxide (β -Ga_2O_3) optoelectronic devices, sensing-memory-computing integration, and UV spectroscopy technologies. He has published multiple peer-reviewed papers in leading journals and international conferences in the fields of wide-bandgap semiconductor photodetectors, in-sensor computing architectures, and computational spectroscopy.

Title: β -Ga2O3 Photodetector Arrays for Ultra-Weak UV-C Detection and AI-Enhanced Imaging via Oxygen Vacancy Engineering

Abstract: Due to strong atmospheric absorption of ultraviolet (UV) radiation, particularly in the UV-C band, ultra-weak UV light at the nW/cm2 level is challenging to detect, sense, and utilize. To address this limitation, we report a 28×28 β -Ga2O3 array with enhanced photosensitivity through the introduction of deep-level oxygen vacancies to reconstruct the energy band structure. The array is capable of detecting UV-C radiation as low as 3 nW/cm2, which represents the lowest reported threshold in the UV-C band to date. Leveraging the array's exceptional sensitivity and uniform response, we further developed an image preprocessing algorithm to enhance weak UV light imaging. Validation with Fashion-MNIST dataset shows a 25% improvement in CNN recognition accuracy. The optimized preprocessing is shown to be critical for complex visual analysis, boosting instance segmentation quality, measured by Weighted Average Intersection over Union (IoU), by a remarkable 33%. This demonstrates the array's potential for practical ultra-weak UV-C detection and imaging applications.

Technical Sessions

D3-PM-A11: Award Finalist Session: Best Student Paper

13:30-15:30, April 19, 2026 **Convention Hall F**

Session Chair: Guang Yao, UESTC; Zegao Wang, SCU

13:30-13:45	**Paper ID:** Oral# 351 **Paper Title:** Three-Dimensional Interconnected Thin-Film Thermocouple Array for In-Situ Temperature Mapping Inside Fuel Cells **Presenter:** Yujie Zheng, Xiamen University
13:45-14:00	**Paper ID:** Oral# 353 **Paper Title:** Calibrating Mechanical Properties of In2Se3 in Different Phases Using Nanomachanical Resonators **Presenter:** Lingyu Zhu, Shanghai Jiao Tong University
14:00-14:15	**Paper ID:** Oral# 357 **Paper Title:** Nonlinear Dynamics and Mechanical Properties of Few-Layer MoSe2 Nanomechanical Resonators **Presenter:** Shuang Cai, University of Electronic Science and Technology of China
14:15-14:30	**Paper ID:** Oral# 360 **Paper Title:** A High-Flowrate Valveless Piezoelectric Micropump with a Central Anchor Structure **Presenter:** Jiahui Ni, Hangzhou Dianzi University
14:30-14:45	**Paper ID:** Oral# 361 **Paper Title:** Automatic Layout and Routing of High-Power BAW Filters Using Swarm Intelligence and Shape Optimization **Presenter:** Jie Tang, Hangzhou Electronic Science and Technology University
14:45-15:00	**Paper ID:** Oral# 365 **Paper Title:** Systematic Optimization of Two-Terminal α-In2Se3 Ferroelectric Memory Properties **Presenter:** Xiaoyu Guo, Shanghai Jiao Tong University
15:00-15:15	**Paper ID:** Oral# 387 **Paper Title:** Tri-Level Hemispherical Microstructures for Ultra-Sensitive Flexible Pressure Sensors **Presenter:** Linjing Wu, Xiamen University
15:15-15:30	**Paper ID:** Oral# 48 **Paper Title:** Needle-shaped Multichannel Recording Electrode for Spinal Dorsal Root Entry Zone (DREZ) Ablation **Presenter:** Yuxing Pang, Peking University
15:30-15:45	**Paper ID:** Oral# 417 **Paper Title:** Design and Performance Analysis of a Vibration-Resistant MEMS Vector Hydrophone with Circular Inner Frame **Presenter:** Haoxuan Li, North university of China

Technical Sessions

D3-PM-A12: Advanced Optical Nanometrology and Nanoscopy

13:30-15:00, April 19, 2026 **Convention Hall C**

Session Chair: Renjie Zhou, The Chinese University of Hong Kong

Keynote Speaker

13:30-14:00

Shih-Chi Chen

The Chinese University of Hong Kong

Bio: Dr. Shih-Chi Chen is a Professor in the Department of Mechanical and Automation Engineering at the Chinese University of Hong Kong. He received his B.S. degree in Mechanical Engineering from the National Tsing Hua University, Taiwan, in 1999; and his S.M. and Ph.D. degrees in Mechanical Engineering from the Massachusetts Institute of Technology, U.S., in 2003 and 2007, respectively. Following his graduate work, he entered a post-doctoral fellowship in the Wellman Center for Photomedicine, Harvard Medical School, where his research focused on biomedical optics and endomicroscopy. From 2009 to 2011, he was a Senior Scientist at Nano Terra, Inc., a start-up company founded by Prof. George Whitesides at Harvard University, to develop precision instruments for novel nanofabrication processes. His current research interests include ultrafast laser applications, biomedical optics, precision engineering, and nanomanufacturing. Dr. Chen is a Fellow of Optica (formerly OSA), Fellow of SPIE, Fellow of American Society of Mechanical Engineers (ASME), and members of the American Society for Precision Engineering (ASPE) and Hong Kong Young Academy of Sciences (YASHK). He currently serves as the Associate Editor of ASME Journal of Microand Nano-Manufacturing, IEEE Transactions on Nanotechnology, and HKIE Transactions. In 2003 and 2018, he received the prestigious R&D 100 Awards for developing a six-axis nanopositioner and an ultrafast nanoscale 3-D printer respectively

Title: Closed-loop Two-photon Lithography based on a Single-cavity Dual- comb Laser

Abstract: Two-photon lithography (TPL) has been widely used to fabricate various 3D structures and devices with better than 200-nm resolution. Yet, a major challenge that has been consistently overlooked is its limited reproducibility, where nanoscale features can only be realized via careful process tuning, making it impractical for industrial applications. Although metrology methods such as atomic force microscopy provide precise surface morphology, such post fabrication measurement cannot address the low reproducibility issue. Here, we present a TPL platform based on a single-cavity dual-comb laser, where 90% of the first comb’ s power performs continuous TPL at 800 nm (after wavelength conversion) and simultaneously the dual-comb system performs in-situ phase measurement at 1052 nm over the entire work field, generating instantaneous phase and height information at ~360 Hz. The measured phase

information is fed to a dynamic model for modulating the printing parameters (including laser power, scanning rate, and exposure time) to correct height errors in a fully automated fashion. In the experiments, we demonstrated continuous fabrication of millimeter-scale diffractive optical elements and Fresnel zone plate lenses over 14 hours with substantially improved signal-to-noise ratios, process repeatability, and focus quality. These results show that the closed-loop dual-comb platform is a costeffective solution for high-precision TPL.

Invited Speaker

14:00-14:20

Wei Zheng

Research Center for Biomedical Optics and Molecular Imaging, Shenzhen Key Laboratory for Molecular Imaging, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences

Bio: Dr. Wei Zheng is a professor in Shenzhen Institutes of Advanced Technology (SIAT), Chinese Academy of Sciences, China. He received his B.S. degree in Optical Engineering from Zhejiang University in 2003, and his Ph.D. degree in Electronic and Computer Engineering from Hong Kong University of Science and Technology in 2011. After his graduation from HKUST, he jointed into SIAT as an associate professor. In 2016, he was promoted to professor. His current research interests focus on developing novel biomedical imaging techniques. He has authored and co-authored more than 100 journal and conference articles which were published on Nature Methods, Optics Letters, Optics Express, and so on. He is a member of Optical Society of America, a senior member of Chinese Optical Society and a senior member of Chinese Society of Biomedical Engineering.

Title: Development and Application of Novel Two-Photon Microscopy

Abstract: Two-photon microscopy (TPM) allows observation of cellular and subcellular dynamics and functions in deep live tissue within highly complex and heterogeneous environments, providing critical in situ and in vivo information for biological studies. In past decades, we have witnessed the striking development of TPM which has significantly revolutionized biomedical research. In this talk, I will present several novel TPM systems developed in our lab recently, as well as their application in biological studies. A short wavelength excitation time- and spectrum- resolved TPM system was instrumented to detect the endogenous fluorophores in biological tissues. A TPM system equipped with adaptive optics to extend its field-of-view which is 20 times larger than that of conventional system. Finally, an axial gradient excitation TPM will be exhibited. It can accelerate the volumetric imaging speed about 10 times quicker than conventional one.

Invited Speaker

14:20-14:40

Guofeng Zhang

Xi'an Jiaotong University

Bio: Guofeng Zhang is currently an associate professor at Xi’an Jiaotong University(XJTU). He received his MEng degree in Mechanical Engineering and PhD degree in Instrumentation Science and Technology from XJTU in 2015 and 2020, respectively. His research focuses on micro/nano optical measurement technologies for integrated circuit manufacturing and ultra-precision machining.

Dr. Zhang has published more than 40 peer-reviewed papers and contributed over 20 conference talks, and has been granted 23 invention patents. He has received the First Prize of the Science and Technology Progress Award from the Chinese Society for Measurement, the First Prize of the Shaanxi University Science and Technology Award.

Title: Novel Methods for 3D Characterization of Nanostructures

Abstract: As IC manufacturing nodes advance to the 2nm technology node and beyond, the transition to complex three-dimensional architectures such as gate-all-around nanosheets and forksheet devices introduces unprecedented challenges for nanoscale metrology. The shrinking critical dimensions, combined with new materials and intricate stacked geometries, demand characterization techniques with higher sensitivity, resolution, and throughput than ever before. This report presents recent progress by our team in the field of patterned wafer metrology and inspection. We introduce novel optical methods for detecting nanoscale defects, alongside advanced composite nanoprobe techniques for true 3D structural characterization. These approaches are designed to address the limitations of current measurement paradigms, providing new solutions for advanced node nanometrology.

Invited Speaker

14:40-15:00

Bowen Zhu

Westlake University

Bio: Bowen Zhu received his B.S. degree in chemistry from Jilin University, China, in 2010. He obtained his PhD degree in materials science and engineering in 2016 from Nanyang Technological University, Singapore. From 2016 to 2017, he was a postdoctoral scholar in the Department of Materials Science and Engineering, UCLA. From 2017 to 2019, he worked at Department of Chemical Engineering at Monash University, Australia, as a Discovery Early Career Researcher Award (DECRA) fellow. He joined the Department of Electronic and Information Engineering (EIE), School of Engineering, Westlake University, China, in August 2019, and was promoted to associate professor (tenured) starting from January 2025. He was recognized as MIT TR35 (Asia Pacific), and a Highly Cited Researcher (Cross-Field) by Clarivate in 2024. He was elevated to be an IEEE Senior Member in 2025. His research is focused on oxide thin film transistors, active-matrix sensor arrays, and neuromorphic devices. He has published more than 100 research papers on top journals

and conferences, including Science, Science Advances, Science Robotics, Nature Electronics, Nature Communications, Advanced Materials, IEEE IEDM, IEEE EDL, etc., with a total citation of >12000 and a H-index of 49 (google scholar).

Title: Flexible Active-Matrix Sensor Arrays based on Oxide Transistors

Abstract: Flexible and wearable sensors play important roles in applications of electronic skin, healthcare, and human-machine interfaces. Thin-film transistors (TFTs) are the core electronic components for constructing large-area, active-matrix flexible sensor arrays with high spatial resolution. Metal oxide semiconductors (MOSs) based TFTs hold great promises for emerging applications in active-matrix flexible sensor arrays by virtue of their high optical transparency, large-area uniformity, sound electrical performance, and capability of being fabricated via low-temperature solution-based processes. However, current flexible sensor arrays based on solution-processed MOS TFTs often exhibited inferior device performance, severe mechanical mismatch with soft, dynamic bio-interfaces, and low spatial-resolution in signals mapping.

To address these challenges, we developed low-cost, solution-processed metal oxide semiconductors based TFTs to serve as the driving back-panel for dynamic sensor arrays, where each sensor pixel is monolithically integrated with one or more TFT devices via source/drain electrodes. In this way, each sensor can be arbitrarily accessed and controlled by TFTs, providing fast-switching speed and high density. Furthermore, the TFTs based dynamic sensor arrays could be readily integrated with printed circuit board (PCB) and signal processers, providing real-time, user-readable signal mappings of force and/or pressure distributions. With the TFT back-panel, we reshaped the flexible tactile sensors by transforming the passive, static, and dispersed sensors into active, dynamic, and highly integrated sensor arrays.

Technical Sessions

D3-PM-A13: Award Finalist Session: Best Student Paper

13:30-15:30, April 19, 2026 **Convention Hall D**

Session Chair: Ting Wang, NUPT; Xiuhan Li, BJTU

13:30-13:45	**Paper ID:** Oral# 120 **Paper Title:** A Wearable Stretchable Bimodal Contact Lens System for Real-Time Closed-Eye IOP and Eye Movement Monitoring **Presenter:** Xingyi Gan, University of Electronic Science and Technology of China
13:45-14:00	**Paper ID:** Oral# 126 **Paper Title:** Synergistic Optical-Electrical Manipulation on Biochip for Active Medium Classification and Enrichment **Presenter:** Fan Yang, Beijing Institute of Technology
14:00-14:15	**Paper ID:** Oral# 130 **Paper Title:** A Concentric-Ring MEMS Micromirror Array for 3D Optical Scanning **Presenter:** Chen Liu, Chongqing University
14:15-14:30	**Paper ID:** Oral# 132 **Paper Title:** Fabrication of Free-Standing Piezoelectric Nanofilms for Microrobotic Applications **Presenter:** Jingxian Lin, Shanghai Jiao Tong Univerisity
14:30-14:45	**Paper ID:** Oral# 139 **Paper Title:** Directional Ice Templating as a Manufacturing Strategy for Bioinspired Tubular-Porous PLA Microneedles for Minimally Invasive ISF Sampling **Presenter:** Jiahao Li, The University of Tokyo
14:45-15:00	**Paper ID:** Oral# 140 **Paper Title:** Counter-Flow Fin-Shape Rods Bluff Body Parameterized Optimization for Enhanced Wind-Induced Vibration Energy Harvester **Presenter:** Jian Qiu, Chongqing University
15:00-15:15	**Paper ID:** Oral# 155 **Paper Title:** Elliptical Piezoelectric MEMS Vibration Sensor with Low Transverse Sensitivity and Wide Dynamic Range **Presenter:** Zhiwei You, Peking University
15:15-15:30	**Paper ID:** Oral# 164 **Paper Title:** High-Resolution Fabrication of One-Dimensional SWCNTs Transistors Using Thermal Scanning Probe Lithography **Presenter:** Hongtao Li, Beijing Institute of Technology

Technical Sessions

D3-PM-B01: Emerging Electromechanical Transduction and Multimode Sensing

16:00-17:20, April 19, 2026 **Meeting Room 301A**

Session Chair: Longfei Wang, Beijing Institute of Nanoenergy and Nanosystems, CAS

Invited Speaker

16:00-16:20 **Yunlong Zi**

Hong Kong University of Science and Technology – Guangzhou

Bio: Prof. Yunlong Zi, Ph.D., FInstP, SMIEEE, is an Associate Professor in Thrust of Sustainable Energy and Environment in Hong Kong University of Science and Technology – Guangzhou (HKUST-GZ). Dr. Zi received his Ph.D. in Physics from Purdue University in 2014; his Bachelor of Engineering in Materials Science and Engineering from Tsinghua University in 2009. Before joining HKUST, he worked as an Assistant Professor at the Chinese University of Hong Kong during 2017-2022, and a Postdoctoral Fellow at Georgia Institute of Technology during 2014-2017. His current research interests mainly focus on triboelectric energy harvesting, biomimetic tactile sensing, visualized tactile sensing, and self-powered wireless sensing systems. He has published almost 200 journal publications in top-notch journals, with citation of >20000 and H-index of 75. He was honored by Clarivate Highly-Cited Researcher 2025; Inaugural HKUST-GZ Lionel M. NI and Yin CHING Outstanding Teaching Award 2025; Elsevier/Stanford Top 2% Scientists "Career-long Scientific Impact" List 2024&2025; Fellow of Institute of Physics (IOP) 2023; NSFC Excellent Young Scholar (Oversea) 2023; Guangdong Distinguished Young Scholar 2023; the MIT Technological Review Asia & Pacific 35 Innovators Under 35 (TR35) 2022; Nano Energy Award 2021; Emerging Investigator by Journal of Materials Chemistry C 2018; MRS Postdoctoral Award winner 2017; and one of "5 students who are transformation makers" by Purdue University 2013.

Title: Multimodal Tactile Sensing enabled by Triboelectricity

Abstract: While tactile sensing is fundamental for embodied intelligence to physically interact with and understand the world, its complex, multimodal nature remains a significantly under-explored frontier compared to vision, hearing or other types of sensing. The major challenge in tactile sensing lies in its multimodal nature, since it includes comprehensive information related to force/pressure, softness, friction, surface roughness, temperature, etc. As naturally based on the tactile behavior, triboelectrification (or contact electrification) may provide a paradigm-shift strategy for multimodal tactile sensing. Our team already demonstrated a hemispherical bimodal intelligent tactile sensor array using the triboelectric effect, which is capable of softness identification, modulus quantification, and material type recognition. We also utilized tribo-induced electroluminescence to visualize tactile sensing information, with improved

brightness and low detection limit. Besides, electrotactile textile haptic glove based on triboelectric-discharge effect was also developed to simulate high-resolution tactile information. More multidisciplinary collaborative studies are expected to achieve high-resolution and multimodal tactile sensing and feedback systems toward embodied intelligence.

Invited Speaker

16:20-16:40

Dan Yang

Beijing University of Chemical Technology

Bio: Dan Yang received her Ph.D. in Materials Science and Engineering from Beijing University of Chemical Technology in 2014. Now she is a professor in Beijing University of Chemical Technology. Her main research interests have been focused on the design and preparation of functional polymer composites and self-powered nanogenerators.

Title: Self-Powered and Self-Healing Dielectric Elastomer Actuators Based Artificial Muscle With Triboelectric Nanogenerators

Abstract: Dielectric elastomer actuators (DEAs) have been intensively studied as a promising candidate for artificial muscle. However, their high voltage requirements and vulnerability to external damage limit their widespread application and long-term service life. To extend the service lifetime of DEAs, reversible covalent bonds, such as disulfide bonds and imine bonds have been constructed in polymer chains to design self-healing DEs. Furthermore, a triboelectric nanogenerator (TENG) with characteristics of a high output voltage and a low current was used to drive the self-healing DEA, resulting in a self-powered and self-healing DEA system (TENG-SDEA), which ensures the safe operation of the DEA and avoids electrical breakdown. Finally, an extraocular-muscle-like actuator with oriented motion ability integrated by several TENG-SDEAs was constructed. Additionally, the SDEA was directly used as a flexible capacitive sensor for real-time monitoring of the patient’s motion. The presented SDEA provides guidance not only for the artificial muscles that mimic natural muscles but also for future intelligent integrated devices.

Invited Speaker

16:40-17:00

Hao Wu

South China University of Technology

Bio: Hao Wu is a professor at the School of Physics and Optoelectronics, South China University of Technology. She received the Ph.D. degree from the University of Twente, the Netherlands, and conducted postdoctoral research at the Chinese University of Hong Kong and the City University of Hong Kong. In 2022, she joined South China University of Technology, establishing a research group focused on energy harvesting and smart sensing. Her research explores the fundamental principles of converting small-scale mechanical energy into electrical energy, particularly through water-solid interaction mechanisms. Leveraging these insights, she develops technologies to efficiently harvest energy from waves, droplets, and biomechanical motions. She also investigates

self-powered electronics driven by environmental mechanical energy, with applications in wearable devices, health monitoring, and remote wireless sensing. Prof. Wu has published more than 30 peer-reviewed papers in top-tier journals, including Nature Communications, Physical Review Letters, and Advanced Materials, delivered over 20 invited talks at international conferences, and holds more than 20 authorized invention patents. She has received multiple academic honors, including the Overseas Young Talents Program and the Xiaomi Young Scholar Award. Prof. Wu serves as a referee for several highly reputable journals such as Nature, Nature Communications, Joule, and Nano Energy.

Title: Water-Based Electromechanical Transduction

Abstract: When water comes into contact with a specific solid surface, static triboelectric charges can be generated or electrostatic charges induced, and the two phenomena may even occur simultaneously. By rationally utilizing the interaction between water and a pre-charged hydrophobic surface, or via water–solid contact electrification, the mechanical energy associated with water motion can be converted into electrical energy. Based on this principle, water-based electric nanogenerators enable the harvesting of diverse ambient mechanical energies, including those from water droplets, ocean waves, and body motions. In this presentation, I will introduce water-based electromechanical transduction devices from the perspectives of mechanisms, methodologies, and applications.

Invited Speaker

17:00-17:20

Zhongjie Li

Shanghai University

Bio: Li Zhongjie is an associate professor at Shanghai University. Engaged in theoretical research and technological development of energy supply for marine unmanned systems. He has granted 11 major projects as PI, with total funding exceeding 17 million Yuan. In recent years, he has published over 100 academic papers in the field of energy supply for marine unmanned systems, with 13 papers recognized as ESI Highly Cited Papers and 4 as ESI Hot Papers. His work has been cited and positively evaluated by over 100 academicians and fellows. In 2025, he received the First Prize of Shanghai Natural Science Award. He has been consecutively listed among the World's Top 2% Scientists from 2023 to 2025. In 2022, he won the First Prize of the Ministry of Education for Scientific and Technological Progress. He received the Best Paper Award at the 2021 ICANDVC International Conference, the ASME Best Paper Award, and the 2024 IJPEM-GT Paper Award. He was awarded the 2025 Outstanding Reviewer Award by IOP. He was honored as one of the "Shanghai Science and Technology 35 under 35" in 2022. He has been selected for the Shanghai "High-Level Overseas Talent Program", "Rising-Star Program A", and "Sailing Program". His research has been applied to polar scientific expeditions and the exploration and salvage of ancient shipwrecks. He developed a self-powered unmanned monitoring robot based on step-change magnetic field technology, enabling energy

self-sufficiency in the self-powered monitoring of hydrological environments. He serves on the editorial boards of several renowned journals.

Title: Abrupt Magnetic Flux Density Change in Electromagnetic Energy Harvesters: Initiative, Concept and Effect

Abstract: This presentation examines the concept and applications of abrupt magnetic flux density changes in electromagnetic energy harvesters (EMEHs). It begins by introducing the research initiative, followed by a detailed exploration of design principles to optimize performance. Key findings include an optimal value of 3 for peak efficiency, ideal structural parameters such as wire diameters and coil thickness, and the superior output of alternating magnet arrangements, with one configuration generating 358.6 mW of power. The research further demonstrates significant practical outcomes. Configurations include a hybrid piezoelectric-electromagnetic system achieving 2.1 W of instantaneous power, capable of charging a 3.7V battery in 20 minutes; and a low-frequency harvester that operates below 1 Hz, producing 144 mW. These results underscore the effectiveness of abrupt magnetic flux changes in enhancing energy harvesting efficiency, paving the way for advanced self-powered devices and sustainable energy solutions.

Technical Sessions

D3-PM-B02: Flexible Functional Materials and Devices

16:00-18:00, April 19, 2026 **Meeting Room 301B**

Session Chairs: Zhenlong Huang, UEST & Hulin Zhang, TYUT

Invited Speaker

16:00-16:20 **Zhuocheng Yan**

Shandong University

Bio: Zhuocheng Yan is a Professor at the School of Integrated Circuits, Shandong University. He received his B.S. degree in Electronic Science and Technology in 2015 and his Ph.D. degree in 2021 from the Universsity of Electronic Science and Technology of China. From 2018 to 2020, he was a visiting scholar at the University of California, Los Angeles (UCLA). His research interests include flexible inorganic thin-film transistors and wearable electronic devices. He has published over 20 SCI/EI papers with more than 600 citations, holds 12 invention patents, and has 2 software copyrights. His representative papers have been published in Science, Advanced Materials, Advanced Science, ACS Applied Materials & Interfaces, and Nano Research. He received the Royal Society of Chemistry (RSC) Horizon Prize in 2024 and is recognized as a National Young Talent in China.

Title: Flexible Inorganic Thin-Film Transistors and Sensors

Abstract: Flexible inorganic thin-film transistors (TFTs) and sensors have attracted significant attention for next-generation wearable and bio-integrated electronics due to their high electrical performance, mechanical reliability, and compatibility with large-area fabrication. This presentation gives an overview of recent progress in flexible inorganic TFTs based on oxide and van der Waals semiconductors and their integration with sensing systems. A freestanding van der Waals electronic film composed of two-dimensional nanosheets is introduced, enabling breathable, stretchable, and bio-integrated electronic membranes with skin-gated and leaf-gated transistor configurations for high-fidelity electrophysiological signal monitoring. Device design strategies, including electrolyte-gated structures and extended-gate configurations, are further discussed to achieve low-voltage and high-sensitivity biomarker sensing. In addition, several flexible and stretchable electronic sensing platforms for on-body physiological monitoring are presented, highlighting their applications in health monitoring and human–machine interaction. The combination of high-performance inorganic semiconductor devices with flexible structural design provides promising opportunities for scalable and reliable flexible electronic systems.

Invited Speaker

16:20-16:40 **Yunwoo Lee**

Soongsil University

Bio: Yunwoo Lee is currently an Assistant Professor in the Department of Mechanical Engineering at Soongsil University, Seoul, South Korea, since March 2025. He received the Ph.D. degree in Mechanical Engineering and Simulation Technology from the University of Stuttgart and the Max Planck Institute for Intelligent Systems, Stuttgart, Germany, in 2023, under the supervision of Dr. Metin Sitti. He previously received his Master's degree in Nanomechatronics from the University of Science and Technology (UST) in collaboration with KIMM in 2017, and his Bachelor's degree in Mechanical Engineering from Handong Global University in 2013.

Prior to joining Soongsil University, he worked as a Postdoctoral Researcher at the Korea Institute of Machinery and Materials (KIMM) from March 2024 to February 2025. His research interests encompass micro/nanofabrication, stimuli-responsive materials, 3D microprinting via two-photon lithography, micro robotics, and microneedle, with a particular focus on targeted drug delivery and minimally invasive biomedical applications.

Title: Self-Adaptable Microrobot for Biomedical Application

Abstract: The human body presents highly complex and unstructured conditions—varying pH levels, temperature gradients, rough tissue surfaces, and wet biological interfaces—demanding adaptive robotic systems for reliable in vivo operation. Untethered mobile microrobots smaller than 1 mm hold significant promise for minimally invasive therapeutic delivery; however, conventional fabrication approaches face fundamental scalability barriers at the microscale, highlighting the urgent need for innovative adaptive microrobot designs. To address these challenges, this work presents self-adaptable microrobot platforms integrating stimuli-responsive active materials with 3D direct laser printing, enabling wireless actuation without batteries or tethered connections. Inspired by biological organisms, the proposed microrobots autonomously adapt their shape, adhesion, and locomotive behavior in response to environmental cues including magnetic fields, temperature, and pH. The proposed designs collectively demonstrate decoupled multi-responsive behaviors, including magnetically guided locomotion, controllable tissue adhesion, and on-demand cargo release, highlighting their strong potential for targeted drug delivery and minimally invasive biomedical intervention.

Invited Speaker

16:40-17:00 **Yang Li**

Shandong University

Bio: Li Yang, professor and doctoral supervisor, serves as the vice dean of the Integrated Circuit Institute of Shandong University. He is a national young talent, an IEEE senior member, a young scientist in cooperation between China and South Korea by the Ministry of Science and Technology, a Tai Shan Scholar of Shandong Province, the leader of an

integrated circuit innovation team in Shandong universities, a recipient of the Outstanding Young Scientist Fund of Shandong University, an outstanding young scholar of Shandong University, a Qilu Young Scholar, a high-level talent of Shandong Province, and a national-level talent of Shandong Province. He has been responsible for nearly 20 provincial and ministerial-level key projects, including national natural science foundation projects, projects of the Ministry of Science and Technology, major basic research projects of Shandong Province, and key research and development plans of Shandong Province. He has published over 200 SCI-indexed papers, including more than 150 SCI-indexed articles as the first author or corresponding author in top journals such as Sci. Adv., PNAS, Chem. Soc. Rev., Matter, Adv. Mater., etc., including 15 cover articles. He has 15 high-impact papers and 15 hot papers. His H-index is 50. He has 30 national invention patents and 11 Korean invention patents. He serves as a project review expert of various ministries and commissions, as well as a special editor and (young) editor of several SCI journals.

Title: Flexible Intelligent Cognitive Devices and Integrated Systems

Abstract: Flexible intelligent cognitive devices and integration system is geared to the needs of a new generation of information technology and the demand of intellisense important development direction, the wearable electronics, intelligent robot, health monitoring and human-computer interaction, and other fields have broad application prospects. This report around flexible electronics and the development trend of intelligent information processing depth fusion, system in this paper, the key scientific problems of flexible intelligent cognitive devices and technology path. First of all, from the aspects of material and devices, analyzing flexible semiconductor materials, micro-nano structure design, and interface control high sensitivity to the device, the influence of the multimodal perception and signal stability mechanism; Secondly, this paper discusses the flexible sensor for high quality signal acquisition in a complex environment with many key technology of information fusion, focuses on the flexible tactile, stress and physical field coupling perception mechanism; Finally, around "- save - is" integration development trend, is introduced based on the edge of the new device structure intelligent implementation path and its integration method in the flexible system. This report focuses on the development trend of the deep integration of flexible electronic devices and intelligent information processing, and systematically elaborates on the key scientific issues and technical paths of flexible intelligent cognitive devices. Firstly, from the perspective of materials and devices, the influence mechanisms of flexible semiconductor materials, micro-nano structure design, and interface regulation on the high sensitivity, multi-modal perception, and signal stability of the devices are analyzed; Secondly, the key technologies for achieving high-quality signal acquisition and multi-information fusion in complex environments by flexible sensors are discussed, with a particular focus on flexible tactile, pressure, and multi-physical field coupling perception mechanisms; Finally, around the development trend of "sense-store-compute" integration, the implementation paths of edge intelligence based on new device structures and their integration methods in flexible systems are introduced.

Invited Speaker

17:00-17:20

Hulin Zhang

Taiyuan University of Technology

Bio: Hulin Zhang is a professor and doctoral supervisor at Taiyuan University of Technology. He is also a member of the Academic Committee and the director of the Academic Committee of the College of Integrated Circuits. He has been awarded the title of "Outstanding Young Talent of Shanxi Province" and "Sanjin Talent". The research field is self-driven electronic skin based on thermoelectric hydrogels. More than 130 SCI papers have been published. As the first or corresponding author in Nat. Commun., Nano Lett., ACS Nano, Adv. Funct. Mater., more than 80 papers have been published, with over 12,000 citations and an H-index of 52. He was awarded the Second Prize of Natural Science of Shanxi Province (ranked first), Outstanding Young Scientist of Microsystems & Nanoengineering, and JMCC Emerging Investigator, Shanxi Province Science and Technology Merit Award, Shanxi Province Model of Teacher Ethics in Colleges and Universities, Taiyuan University of Technology Youth May 4th Medal, Advanced Individual in "Three Educations", etc. He has presided over the National Natural Science Foundation of China (including youth, general, and joint key projects), sub-projects of the National Key Research and Development Program, and the China Postdoctoral Science Foundation (including general and special funding), etc.

Title: Self-Powered Gel Wearable Electronics for Human Full-Domain Perception

Abstract: Wearable electronic skin for full-domain perception is an important frontier in flexible electronics, with its core lying in replicating the multi-modal perception and closed-loop feedback capabilities of human skin. Professor Zhang Hulin's team from Taiyuan University of Technology has developed a gel electronic skin system based on PVA hydrogel, which integrates self-driving, flexibility and multi-functional perception. This system combines thermoelectric, piezoresistive and piezoelectric effects to build a collaborative perception network, achieving self-driving through the thermoelectric effect and capturing static pressure and dynamic strain signals through piezoresistive and piezoelectric effects respectively. In terms of application, the team has demonstrated three representative achievements: a thermochromic gel patch for visual monitoring of facial physiological signals; a bionic fingertip tactile sensor combined with deep learning for high-precision material recognition; and a signal decoupling model that builds a closed-loop of human-machine interaction from human perception, machine execution to tactile feedback. This work integrates the advantages of materials, devices and algorithms, systematically enhancing the capabilities of gel electronic skin in self-driving multi-modal perception and information interaction, providing a reliable path for health monitoring, soft robots and human-machine integration technologies.

Invited Speaker

17:20-17:40

Weili Deng

Southwest Jiaotong University

Bio: Dr. Weili Deng is currently an Associate Professor at Southwest Jiaotong University in China. has been a visiting scholar at both the University of California, Los Angeles (UCLA) and the University of California, Riverside (UCR). He has also been recognized among the world's top 2% most-cited scientists.

His research centers on functional devices that operate through electrical signal transduction, with a focus on uncovering the structure – property relationships that link the hierarchical architecture of nanomaterials to the macroscopic performance of devices. He is particularly dedicated to advancing the application of flexible sensors in areas such as wearable technology and human – machine interaction.

In recent years, as first or corresponding author, he has published more than 50 papers in leading international journals, including Chemical Society Reviews, Advanced Materials, Matter, Advanced Functional Materials, ACS Nano, Nano-Micro Letters, and InfoMat. Among these publications, 1 has been recognized as an ESI Hot Paper, 8 as ESI Highly Cited Papers, and 9 have been featured as cover articles. His work has received over 10,000 citations (Google Scholar).

He also serves on the editorial boards of several academic journals, including as a Youth Editorial Board Member for Nano-Micro Letters and Materials Futures, and as an Editorial Board Member for Soft Science, the Journal of Functional Biomaterials, and the Journal of Sichuan University (Natural Science Edition).

Title: Flexible Pressure Sensor Based on Hierarchical Structure Design

Abstract: With the rapid progress in nanotechnology and materials science, flexible electronics are driving a paradigm shift in human-machine interaction, laying the groundwork for the next-generation Internet of Things. Smart flexible wearable devices, capable of multimodal information perception, hold great promise for diverse applications in interactive systems. In particular, the rapid development of 5G technology has accelerated the conformal integration and interconnection of flexible wearable sensors, enabling highly sensitive sensing networks. These advances provide essential data support for intelligent living and are poised to have a profound impact on socioeconomic development. To further enhance the overall performance of flexible wearable devices, current research focuses on two primary directions: the design of functional materials and the innovation of device architectures. This report centers on the design and optimization of functional materials, with a systematic introduction to hierarchically structured functional materials and their applications in flexible wearable devices. By analyzing the electromechanical coupling mechanisms and conversion characteristics under piezoelectric and piezoresistive operation modes, the report explores cutting-edge applications and practical progress of such flexible sensors in wearable human body sensing.

Invited Speaker

17:40-18:00

Zhenlong Huang

University of Electronic Science and Technology of China

Bio: Zhenlong Huang is currently an Associate Professor at the School of Materials and Energy, University of Electronic Science and Technology of China (UESTC). He received both his Bachelor's (2012) and Ph.D. (2017) degrees from UESTC. From 2015 to 2017, he conducted academic research as a visiting scholar at the University of California, San Diego, focusing on stretchable electronics. In 2018, he joined Huawei Technologies Co., Ltd. as a senior engineer, where he worked on wearable sensor for blood pressure measurement. He returned to UESTC in 2022 to pursue academic research and teaching. His research interests include the three-dimensional integration of stretchable electronics, fabrication strategies for flexible sensors, and the development of wearable systems for health monitoring. He has published multiple research papers as the first author or corresponding author in prestigious journals such as Nature Electronics, Advanced Materials, Advanced Functional Materials, ACS Nano, and others.

Title: Three-dimensional Integrated Stretchable Devices

Abstract: Stretchable devices have attracted increasing attention for applications in healthcare, human–machine interaction, and bioinspired robotics, owing to their mechanical compliance and adaptability to soft and deformable surfaces. However, most existing stretchable systems rely on single-layer, planar integration, in which sensing elements and interconnects are arranged laterally. Such architectures impose fundamental constraints on integration density and functional scalability, limiting the realization of multi-sensing and system-level functions in compact devices. To address these challenges, the development of three-dimensional integration strategies is urgently needed to enable multilayer stacking of stretchable devices and substantially enhance functional density. This presentation introduces a three-dimensional integration technique based on laser-selective etching, which enables multilayer stacking of stretchable devices with significantly improved integration density. Furthermore, by integrating laser direct writing, this approach allows the direct fabrication of stretchable sensors on non-planar and curved surfaces, achieving conformal device patterning while maintaining mechanical robustness and stable sensing performance.

Technical Sessions

D3-PM-B03: Flexible Biosensors

16:00-17:50, April 19, 2026 **Meeting Room 301C**

Session Chair: Minqiang Wang, Shanghai Jiao Tong University

Invited Speaker

16:00-16:20

Mengdi Han

Peking University

Bio: Dr. Mengdi Han is an Assistant Professor in the Department of Biomedical Engineering, College of Future Technology, Peking University. He received his B.S. degree in Huazhong University of Science and Technology in 2012 and Ph.D. degree in Peking University in 2017. He was a visiting Ph.D. student at Department of Materials Science and Engineering, University of Illinois Urbana-Champaign from 2015 to 2017. He worked as a postdoctoral fellow at Querrey Simpson Institute for Bioelectronics, Northwestern University from 2017 to 2020. He published more than 100 SCI-indexed papers, including first/corresponding author papers in Nature Electronics, Nature Biomedical Engineering, Science Translational Medicine, Science Robotics, Science Advances, PNAS, Advanced Materials, etc. His research group focuses on the engineering of miniaturized biomechanical sensing platforms with advanced sensing capabilities. His research has been recognized with many awards including Microsystems & Nanoengineering Young Scientist Award (2020), MIT Technology Review Innovators Under 35 Asia Pacific (2021), iCANX Young Scientist Award (2024), and Asian Young Scientist Fellowship (2024).

Title: Magnetic Implants for Wireless Biosensing

Abstract: Implantable sensors can directly interface with various organs for precise evaluation of health status. However, extracting signals from such sensors mainly requires transcutaneous wires, integrated circuit chips, or cumbersome readout equipment, which increases the risks of infection, reduces biocompatibility, or limits portability. Here, we develop a set of millimeter-scale, chip-less, and battery-less magnetic implants paired with a fully integrated wearable device for measuring biophysical and biochemical signals. The wearable device can induce a large amplitude damped vibration of the magnetic implants and capture their subsequent motions wirelessly. These motions reflect the biophysical conditions surrounding the implants and the concentration of a specific biochemical depending on the surface modification. Experiments in rat models demonstrate the capabilities of measuring cerebrospinal fluid (CSF) viscosity, intracranial pressure, and CSF glucose levels. This miniaturized system opens the possibility for continuous, wireless monitoring of a wide range of biophysical and biochemical conditions within the living organism.

Invited Speaker

16:20-16:40

Yu Song

City University of Hong Kong

Bio: Dr. Yu Song is currently a Presidential Assistant Professor at the Department of Biomedical Engineering at City University of Hong Kong. Before joining CityU, he was a postdoctoral scholar in Prof. Wei Gao’ s group at Caltech and he received his Ph.D. in at Peking University under the supervision of Prof. Haixia (Alice) Zhang. His research interests focus on bioelectronics, wearable sensors, advanced manufacturing, and digital medicine, to achieve wearable bioelectronics for personalized healthcare. In the related fields, he has authored over 80 publications (24 as first/corresponding author) including Science, Nature Biotechnology, Nature Electronics, Nature Biomedical Engineering, Science Robotics, Science Advances, etc., with over 10500 citations and h-index of 44, applied 18 US & China patents, and served as guest editor or independent reviewer for several journals. Dr. Song has been recognized as Clarivate Highly Cited Researcher (2025), World’ s Top 2% Scientist 2022-2025 (Stanford University & Elsevier Scopus) and received over 30 awards, including 2024 Forbes 30 Under 30 Asia, 2024 Microsystems & Nanoengineering Young Scientist Award, 2019 Leadership Scholarship (Committee of 100) and 2020 Excellent Doctoral Dissertation by Chinese Institute of Electronics and China Education Society of Electronics.

Title: Wearable Bioelectronics for Machine Learning-Powered Personalized Healthcare

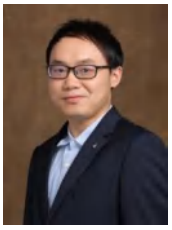
Abstract: In daily life, human natural physiological processes generate a diverse range of biophysical, biochemical, and electrophysiological signals that can be acquired and quantified with multimodal biosensors, providing critically insightful information for health status, qualifying human performance by predictive analytics, and establishing bidirectional communication channels for biotic-abiotic interfaces. The rising research on wearable bioelectronics enables active disease monitoring and remote health management, profoundly impacting the development of personalized healthcare. To facilitate the biomedical applications of early diagnosis, real-time monitoring, and precision therapy, I adopted a bottom-up approach, from the innovation of manufacturing schemes and material properties, preparation of sensitive biosensors, integration of high-efficient energy harvesters, incorporation of artificial intelligence models, to successful development of multimodal wearable bioelectronics. My talk on wearable bioelectronics for personalized healthcare mainly includes, skin-interfaced sweat biosensors for monitoring a wide spectrum of biomarkers (metabolites, electrolytes, proteins, hormones), and machine learning-powered health management towards precision nutrition, behavior prediction, and stress assessment. The developed wearable bioelectronics demonstrates promising prospects in at-home diagnosis, therapeutic drug monitoring, and personalized healthcare.

Invited Speaker

16:40-17:00

Yunsheng Fang

Xi'an Jiaotong University



Bio: Yunsheng Fang is currently a Full Professor at the School of Life Science and Technology, Xi' an Jiaotong University. His research focuses on flexible wearable intelligent diagnosis and treatment systems and wearable ultrasound devices. As the first author and corresponding author (including co-corresponding author), he has published more than 50 papers in journals such as Advanced Materials (2), Chemical Society Reviews, ACS Nano (3), Matter (3), Joule, Materials Today (2), Advanced Functional Materials (2), Small, and Biosensors and Bioelectronics. His papers have received more than 5,000 total citations, with an H-index of 32. Six of his papers are ESI highly cited papers, and seven have been selected as cover articles. He has applied for 11 Chinese invention patents, of which 5 have been granted. He serves as a Youth Editorial Board Member for journals including The Innovation, Nano-Micro Letters, Soft Science, and so on.

Title: Intelligent Wearable Biomedical Systems for Personalized Healthcare

Abstract: Wearable intelligent health management is regarded as a highly promising technical implementation for personalized medicine, which is of great significance for promoting the development of precision medicine and improving human health. However, the currently widely developed wearable technologies still face critical challenges, including poor adaptability to motion and high-humidity environments, difficulties in real-time health data acquisition and analysis, single-function health monitoring, and lack of long-term comfortable monitoring, which severely restrict their practical applications in health management. To address the above problems and challenges, the speaker has conducted research on wearable intelligent health management systems, focusing on three key aspects: based on the development of flexible functional electrodes, the fabrication of flexible and stretchable electrodes suitable for diverse bioelectronic devices has been realized; aiming at the development of personalized health management systems, multimodal biological signal monitoring including bioelectrical, physical, and chemical signals has been achieved; and starting from the monitoring of deep-body human health signals, wearable ultrasound devices with high bandwidth and high sensitivity have been developed.

Invited Speaker

17:00-17:20

You Yu

ShanghaiTech University

Bio: You Yu is an Assistant Professor in the School of Biomedical Engineering at ShanghaiTech University. He received his Ph.D. degree in Changchun Institute of Applied Chemistry, Chinese Academy of Sciences. After that, he worked as a postdoctoral research associate in the department of Medical Engineering at California Institute of Technology. He is a recipient of MINE Young Scientist Award, CAST Young Scientist Award, and

Shanghai 35U35. His research is concentrated on the development and application of wearable bioelectronics, flexible human-machine interface, and medical robotics.

Title: The Rise of Multimodal Sensing Electronics and Activating Soft Interfaces

Abstract: Integration of flexible bioelectronics and biomarker monitoring is a rapidly growing research area driven by its promising potential to assist personal healthcare and sustainable environmental managements. Flexible technology introduces novel devices by merging materials science, device manufacture, and medical application. Here, we have developed series of soft electronic-skin for multiplexed wireless perspiration analysis, selectively measuring a wide spectrum of sweat analytes to provide insightful individual`s health information. On the other hand, flexible robotic electronics that mimic and surpass human sensing capabilities is critical to support the further robotic applications. Till now, integrating ultrasensitive physical and chemical sensors for in situ analytic sensing is rather extremely challenging and underdeveloped. We have developed soft human-machine interface for robotic sensing, which can perform proximity sensing, tactile and temperature perceptual mapping, alongside real-time analysis of chemical threat and biohazards.

Technical Sessions

D3-PM-B04: M/NEMS Resonators

16:00-18:00, April 19, 2026 **Meeting Room 302A**

Session Chair: Xinxia Cai, Aerospace Information Research Institute, CAS

Keynote Speaker

16:00-16:30 **Genzi Li**

China Institute of Standardization and Technology for Machinery (Beijing) Co., Ltd.

Bio: Dr. Genzi Li is the Vice Chief Engineer in the China Institute of Standardization and Technology for Machinery. He obtained his doctoral degree in Mechanical Engineering from the University of Maryland, College Park, MD. Dr. Li is mainly engaged in research related to MEMS reliability and testing technologies. He is the Director of the Beijing Key Laboratory of High-End MEMS Device Reliability Technology, the Secretary-general of the National Micro-electro-mechanical Technology Standardization Technical Committee, a member of the National Integrated Circuit Standardization Technical Committee, a member of the National Optoelectronic Measurement Standardization Technical Committee, a member of the Micro-Nano Devices and Systems Technology Branch of the Chinese Society of Instrumentation, a council member of the Micro-nano Processing Technology Branch of the Chinese Society of Micro-nano Technology, a member of the IEEE Smart Manufacturing Standards Committee, the convenor of ISO/TC10/SC6/WG23 and the convenor of IEEE/P2879. He has led and participated in drafting more than 50 international standards, national standards, and military standards, and has won three provincial and ministerial-level science and technology awards.

Title: Practices and Prospect of MEMS Standardization in China

Abstract: Micro-electro-mechanical Systems (MEMS) technology is one of the cutting-edge technologies based on the development of micro and nano technologies. With advantages of miniaturization, integration, intelligence, low cost, high efficiency, and mass production, MEMS are essential to emerging industries such as the Internet of Things, artificial intelligence, and 5G, and serve as a benchmark for a nation's high-end manufacturing level. In recent years, several MEMS related national standards have been successively released via SAC/TC 336, with ten of them including process standards, device standards, testing standards, etc., upgraded to IEC international standards. The path ahead for MEMS standardization requires top-level design, advanced layout, cultivation and exploration of forward-looking technologies, and the development model of tracking, surpassing, and balancing. It is import that MEMS practitioners can brainstorm and participate widely to jointly promote the standardization of MEMS technology. Through the guidance of MEMS standardization, promote the integration and improvement

of the MEMS industry chain, innovation chain, and standard chain, promote the collaborative development of industry, academia, and research, and continuously enhance the core competitiveness MEMS industry.

Keynote Speaker

16:30-17:00

Yunjia Li

Xi'an Jiaotong University

Bio: Yunjia Li is a professor at the School of Electrical Engineering, Xi ' an Jiaotong University, Xi' an, China, where he served as an associate professor from 2016 to 2021. He received the Ph.D. degree from the Group of Micro and Nanosystems, ETH Zürich, Switzerland, in 2014. His research interests include capacitive/inductive sensors, actuators, and energy harvesters, on both device and system level. He serves as a steering committee member of the IEEE Journal of MEMS and associate editor of the IEEE Transactions on Industrial Electronics. He also serves/served in the AdCom of the IEEE Industrial Electronics Society (IES): as the Chair of the Technical Committee on MEMS and Nanotechnologies, a member of the publication committee, and representative of IES in the IEEE Nanotechnology Council AdCom. He worked as technical committee members, track chairs, and session chairs in multiple IES flagship conferences including IECON, ICIT, ICM, and ISIE.

Title: Self-Power Sensors: From Prototypes to Products

Abstract: This talk focuses on the development of the self-powered sensors based on different energy harvesting technologies. The evolution of the sensors and energy harvesters from concept to prototypes and eventually products will be presented. The implementation of different self-powered systems including the sensors, energy harvesters, power management strategies, and packaging technologies will be discussed. Application related issues such as reliability issues and challenges in industrial environment will also be discussed.

Invited Speaker

17:00-17:20

Hemin Zhang

Northwestern Polytechnical University

Bio: Hemin Zhang received the B.E. degree in electrical engineering and the Ph.D. degree in microelectrome-chanical systems and nanotechnology from NorthwesternPolytechnical University, Xi' an, China, in 2011 and 2017, respectively. From 2019 to 2022, he has been a Post-Doctoral Researcher with ESIEE Paris, University of Cambridge, Cambridge, and KU Leuven. He is currently a Professor with Northwestern Polytechnical University. His research interests include microelectromechanical systems (MEMS) resonators, coupled resonators, mode-localized sen-sors, and their conditioning circuitry.

He was a recipient of the Outstanding Paper Award Finalist at Transducers in 2015, the Outstanding Paper Award Winner at IEEE MEMS in 2016, the Silver Award of Chinese Mechanical Engineering Society (CMES) Hiwin Doctoral Dissertation Award in 2018, and the Marie Skłodowska-Curie (MSCA) Individual Fellowship in 2019. He also served as the TPC member for IEEE MEMS 2026.

Title: Self-Sustaining Oscillators Based on Thermal Actuation and Piezo-Resistive Detection Mechanism

Abstract: Micro/nanomechanical resonators have become key components in high-precision sensors, timing references, and quantum mechanics simulations. Thermal-actuation and piezoresistive-detection mechanisms have been demonstrated as a beneficial method to increase Q of resonators working in ambient environments. Principally, the nanobeam expands once a bias DC current is applied through it, causing defections due to Joule heating power. Consequently, the energy delivered by the input current compensates for the dissipation of the resonator caused by mechanical motion, resulting in a significant improvement on Q. When thermal compensation is sufficient, self-oscillation can be achieved, even in air-operating conditions. This talk will introduce the most recent progress on thermal-piezoresistive sensors especially in the field of physical sensing such as accelerometers.

Invited Speaker

17:20-17:40

Zhipeng Ma

Zhejiang University

Bio: Dr. Zhipeng Ma obtained his M.Sc. and Ph.D degrees in Engineering from Tianjin University, China, in 2012 and Kyoto University, Japan, in 2016, respectively. After a one-and-a-half-year Postdoc career at Kyoto University, he joined Zhejiang University, China. He is now an Associate Professor in the School of Aeronautics and Astronautics and the vice director of the Micro-satellite Research Center. He is also an active member of many domestic and international committes and societies. In 2024, he organized the IEEE International Symposium on Inertial Sensors and Systems as a TPC co-chair. He also serves as the Local Arrangement Chair for MARSS 2026. Dr. Ma is currently engaged in the research of MEMS inertial sensors, MEMS actuators/sensors, and optical image stabilization systems. He has over 30 publications and over 10 patents in the area of MEMS.

Title: Towards a High-performance MEMS Accelerometer with Quasi-zero Stiffness

Abstract: To improve the performance of MEMS accelerometers, we developed the fabrication-friendly approach of forming the quasi-zero stiffness MEMS accelerometers by cancelling out the mechanical stiffness with electrostatic tuning, enabling the reduction of the readout noise. Two control schemes with Pythagorean identity and PWM strategy are proposed for a three-electrode accelerometer configuration to realize a reduced constant-stiffness and high-linearity force-rebalance. And then to further reduce the white noise of accelerometers, we proposed a novel phase-compensation controller for the high quality-factor (Q factor) and quasi-zero stiffness accelerometers. Moreover, a novel force control approach based on dual pulsewidth modulation and mechanical driver-based chopper-stability method is

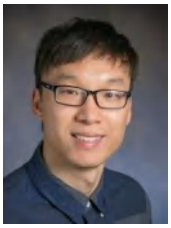
implemented to suppress the leakage of the driving signals and the 1/f noise of the accelerometers.

Invited Speaker

17:40-18:00

Cheng Tu

University of Electronic Science and Technology of China



Bio: Cheng Tu is currently a Research Associate Professor at University of Electronic Science and Technology of China (UESTC). He received the B.S. and M.S. degrees both from UESTC, and Ph.D. degree from City University of Hong Kong. From 2016 to 2019, he worked as postdoctoral research associate in University of Illinois at Urbana-Champaign and Northeastern University successively. He is currently a Research Associate Professor with School of Integrated Circuit Science and Engineering, UESTC, Chengdu, China. His research interests cover from design to simulation to fabrication and electrical characterization of MEMS resonators for applications of high-performance resonant sensors and RF acoustic filters.

Dr. Tu has published more than 60 peer-reviewed papers (M&N, IEEE-EDL, IEEE-TED, IEEE-TUFFC, IEEE-JMEMS, APL, etc.) and contributed several conference talks (IEEE MEMS, Transducers, IEEE NEMS, etc.), and authorized more than 30 invention patents. He has served as a member for the Technical Program Committee of 2021 IEEE NEMS Conference.

Title: High-performance Resonant Sensors based on AlN-on-Si Structure

Abstract: Piezoelectric resonant sensors based on AlN-on-Si structure represent a cutting-edge direction in MEMS sensing technology and have important academic value and industrial application potential. This presentation will briefly show the efforts of our research group in developing various types of AlN-on-Si resonant sensors such as accelerometers, magnetometers, barometers and thermometers. AlN-on-Si resonators offers strong electromechanical coupling using piezoelectric transduction and exhibit high quality factor due to the low damping acoustic cavity usually made of single crystal silicon. In addition, the fabrication process of the AlN-on-Si resonators is CMOS-compatible, which makes it highly attractive from the view of potential monolithic integration with CMOS circuitry. In this talk, I will also show the multi-sensor chip by monolithic integration of different AlN-on-Si resonant sensors.

Technical Sessions

D3-PM-B05: AI for Micro/Nano Electro-Mechanical Systems

16:00-17:40, April 19, 2026 **Meeting Room 302B**

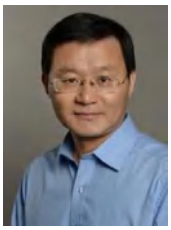
Session Chair: Chong Li, Ocean University of China

Keynote Speaker

16:00-16:30

Guoliang Huang

Peking University



Bio: Dr. Guoliang Huang is currently a Chair Professor of college of engineering at Peking University, and Changjiang Chair Professor at Peking University. He received his Ph.D. degree from University of Alberta, Canada in 2004. Dr. Huang's research interests include wave propagation and mechanics in elastic/acoustic metamaterials and structural materials, active mechanics, topological wave mechanics, structural dynamics, vibration and sound wave suppression. He has authored one book, 7 book chapters and more than 200 journal papers (include Nature Reviews Materials, Nature Communications, Proceedings of the National Academy of Sciences (PNAS), Advanced Materials, Physical Review Letters, Journal of Mechanics and Physics of Solids, et al.), with H-index of 71. He is the Associate Editor of Wave Motion, Associate Editor of the ASME Journal of Applied Mechanics, the ASME Journal of Vibration and Acoustics, the field Editor-in-Chief of Frontiers in Physics, and serves in editorial broad in many other journals.

Title: A Controllable Anti-P-Pseudo-Hermitian Mechanical System and Its Application

Abstract: A novel anti-P-pseudo-Hermitian mechanical system that integrates piezoelectric actuators and sensors with non-reciprocal coupling into mechanical beams is proposed. This configuration enables the system to exhibit programmable exceptional points (EPs), which are critical for enhancing sensitivity in sensing applications. Our theoretical analysis, supported by numerical simulations and experimental validation, demonstrates the system's capability to detect minute mass variations and identify surface cracks with high precision. This advancement not only contributes to the field of non-Hermitian physics but also paves the way for the development of next-generation mechanical sensors leveraging EP physics.

Keynote Speaker

16:30-17:00

Yuzheng Guo

Wuhan University

Bio: Guo Yuzheng: Dean and Professor/Doctoral Supervisor of the School of Power and Mechanical Engineering at Wuhan University, as well as a professor at the School of Integrated Circuits, School of Electrical Engineering and Automation, and Zhongnan Hospital. He is a core member of Professor Liu Sheng's team. He is a recipient of the National Natural Science Foundation of China Outstanding Youth Fund (Project A) and a national-level youth talent program awardee. He earned his Ph.D. and conducted postdoctoral research at the University of Cambridge. He completed his undergraduate studies at the School of Physics, Peking University, and obtained his master's degree from the School of Materials Science and Engineering at the Georgia Institute of Technology. He received his Ph.D. from the Department of Engineering at the University of Cambridge, under the supervision of Professor John Robertson, a Fellow of the Royal Society and the Royal Academy of Engineering. He has previously worked as a researcher at the University of Cambridge and Harvard University. His research focuses on theoretical calculations and experimental studies in areas such as micro-nano fabrication, semiconductor devices and device co-design, wide bandgap semiconductors, ceramic packaging, and high-entropy alloys. He has published over 200 SCI-indexed papers, including communications as the corresponding author in leading international journals such as Nature, Nature Materials, Nature Communications, and Science Advances, with over 10,000 citations. He has led multiple key projects funded by the Organization Department of the Central Committee of the CPC, the Ministry of Science and Technology, the National Natural Science Foundation of China, China Southern Power Grid, and the State Grid Corporation of China.

Title: Systematic Investigation of Temperature Dependences of Elastic Constants of Heavily Doped Silicon via Machine Learning-Based Molecular Dynamics

Abstract: Accurate knowledge of the elastic behavior of doped silicon across a wide temperature range is critical for the design of temperature-stable microelectromechanical systems (MEMS) resonators. In this work, we present a machine learning-assisted molecular dynamics framework to systematically investigate the temperature-dependent elastic constants of heavily phosphorus-doped silicon. A deep potential (DP) model is developed within the Deep Potential Generator (DP-GEN) framework using first-principles data from density functional theory (DFT) calculations. The model captures atomic interactions in doped silicon systems with near-DFT accuracy while enabling large-scale molecular dynamics simulations. Using this approach, we compute the elastic constants of silicon doped at concentrations of 5 × 1019 cm^{-3}, 1 × 1020 cm-3, and 1.5 × 1020 cm-3 over a temperature range relevant to MEMS operation. To validate the model, we fabricate and characterize MEMS resonators with multiple vibrational modes using ultra-heavily doped silicon wafers, extracting the temperature coefficients of elastic constants experimentally. The simulated results show excellent agreement with experimental measurements, with relative errors below 5%, confirming the predictive capability and transferability of the DP model. This

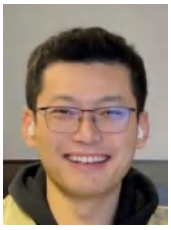
work establishes a reliable and scalable computational framework for characterizing the thermoelastic behavior of doped silicon and provides valuable insights for the design of frequency-stable MEMS devices.

Invited Speaker

17:00-17:20

Chen Wang

University of Leuven (KU Leuven)



Bio: Chen Wang is a senior researcher at micro and nano system group in the University of Leuven (KU Leuven), Belgium. He obtained his Bachelor's degree from Anhui University in June 2013. In June 2018, he successfully defended his PhD dissertation at Zhejiang University, China. Subsequently, in October 2021, he defended a second PhD dissertation at the University of Liège, Belgium. These two theses are entirely independent in both publication output and research topics, with one focusing on optics and the other on micro - electro - mechanical systems (MEMS). His research interests encompass MEMS design and optimization, closed-loop systems for MEMS devices, MEMS pressure sensors, inertial sensors, infrared sensors, and resonators. To date, his research has resulted in 56 (14 in Optics, 42 in MEMS) journal paper publications, 62 conference publications, and 8 patents. He has secured funding from various sources over 1.5 million euros over the last four years.

He has received academic awards such as the Research Excellence Award from SPIE in the U.S., the Best Presentation Award at IMEKO 2014 in Japan, 3rd place in the "MEMS Design Contest 2018", 2nd place in Huawei Europe IC Design and was two best - paper finalists at IEEE MEMS 2022 and UFFC-JS 2024. He is on the technical program committee of top MEMS conferences (2025/2026 IEEE MEMS, 2025 Transducer, 2020 IEEE Sensors, 2022 Eurosensors) and is a session chair for the 2025 Transducer Conference. He gave invited lectures at the Univ. of Macau, Peking Univ., and Chinese Academy of Sciences institutes (SIMIT, IMECAS).

Title: Optimize Freeform Geometries for MEMS Devices with Genetic Algorithm

Abstract: In the past two decades, microelectromechanical systems (MEMS) devices have been applied to all aspects of life and industry and have achieved great commercial success. In the next two decades, with the development of the Internet of Things and autonomous driving, the demand for MEMS devices is expected to grow exponentially. These demands also bring requirements for more functions, higher performance, and lower power consumption of MEMS devices. In order to meet these demands, it is necessary to further optimize existing MEMS devices or design new MEMS devices. However, most existing MEMS devices are right-angle structures, and MEMS devices rarely have curved mechanical structures or more complex free geometric structures.

But in nature, almost all biological forms always exist in curved structures, such as the streamlined body of dolphins and the freely curved tail of monkeys. These curved structures are the result of natural selection, which enables animals and plants to better adapt to the environment and achieve efficient detection and

movement capabilities. Inspired by this, we designed and optimized free curve structures for MEMS based on genetic optimization algorithms and applied them to MEMS accelerometers (sensors) and microgrippers (actuators) respectively. The introduction of free curves greatly improves the performance of these two devices. This design method can be widely applied to various MEMS devices to produce curved MEMS structures of various shapes to achieve performance that is difficult to match with traditional right-angle structures.

Invited Speaker

17:20-17:40

Toshiyuki Tsuchiya

Kyoto University

Bio: Toshiyuki Tsuchiya received the M.S. degree from The University of Tokyo, Japan, in 1993, and the Ph.D. degree from Nagoya University, Japan, in 2004. He worked with Toyota Central Research and Development Laboratories from 1993 to 2004. In 2004, he joined the Department of Mechanical Engineering at Kyoto University, Kyoto, Japan, and currently serves as a Professor in the Department of Micro Engineering at the same university. He is also the Director of the Nanotechnology Hub in Kyoto University. His current research interests include silicon micromachining, its application in MEMS (Micro-Electro-Mechanical Systems), the mechanical property evaluation of micro materials, and the reliability of MEMS devices. Dr. Tsuchiya has been actively involved in numerous international conferences and workshops focusing on MEMS and microsystems, including the International Conference on Solid-State Sensors and Actuators (Transducers) and the International Conference on Micro Electromechanical Systems (IEEE MEMS), where he served as a General Co-Chair for the IEEE MEMS 2013 in Taipei. He is currently an Editorial Board Member of the IEEE Journal of Microelectromechanical Systems, the Journal of Micromechanics and Microengineering, and Micro & Nano Letters. He was honored with the R&D 100 Award for his research on the "Thin film Tensile Tester" in 1998 and the IEC 1906 Award in 2012 by the International Electrotechnical Commission.

Title: MEMS Resonators for Edge AI

Abstract: MEMS resonators are integrated components in sensors, actuators, and timing devices, offering high sensitivity, sophisticated actuation, and high stability and reliability within their microstructures. Their small size and low power consumption have driven widespread adoption in IoT edge devices. By leveraging the temporal retention of input signals through resonance, these devices allow for highly customizable dynamics, ranging from simple oscillations to complex behaviors, via structural innovation and array configurations. Recently, these characteristics have been utilized for in-device signal processing. MEMS resonators satisfy the three requirements for physical reservoir computing: short-term memory, nonlinearity, and high dimensionality. These capabilities suggest that integrating resonators with MEMS-based sensing and actuation could pave the way for autonomous edge processing systems. This presentation highlights our recent work on physical reservoir computing using capacitive MEMS devices and discusses their potential in future Edge AI technologies.

Technical Sessions

D3-PM-B06: Micro-Nano Chemical Sensor

16:00-17:35, April 19, 2026 **Meeting Room 305**

Session Chair: Junbo Wang, Aerospace Information Research Institute, CAS

Keynote Speaker

16:00-16:30 **Juntao Liu**

Aerospace Information Research Institute, Chinese Academy of Sciences

Bio: Liu Juntao, Associate Professor at the Aerospace Information Research Institute, Chinese Academy of Sciences. He serves as a key technical member of national major interdisciplinary projects, a committee member of the Aerospace Medicine Engineering and Space Biology Division of the Chinese Society of Astronautics, a council member of the Beijing Physiological Society, and a committee member of the Micro-Nano Manufacturing Technology Division of the Chinese Mechanical Engineering Society.

Dr. Liu has long been engaged in cutting-edge interdisciplinary research on brain-computer interface device systems and neural detection and regulation technologies. He has led and undertaken multiple national-level projects, proposing an integrated system approach that combines multi-level modulation (optical, pharmaceutical, and electrical) with dual-mode detection of neural electrical activity and neurotransmitter chemistry. He pioneered the development of major scientific research instruments enabling multi-level modulation and dual-mode neural information detection. He was awarded the First Prize of Technological Invention by the Chinese Institute of Electronics in 2022, the Second Prize of Natural Science by the Beijing Municipal Government in 2019, and the Second Prize of Science and Technology by the Beijing Municipal Government in 2012. In the past five years, he has published over 60 high-quality papers in top-tier journals and international conferences, including Nature Communications, National Science Review, and Biosensors and Bioelectronics. He holds 29 authorized invention patents and 5 software copyright registrations.

Title: Implantable Brain-Computer Interface Electrode and Instrumentation Technology

Abstract: Neural microelectrode arrays are fundamental core devices in brain-computer interfaces for detecting the electrical firing of brain neurons and basic chemical information of neurotransmitters. They represent a key direction in emerging electronic information technologies, poised to revolutionize human-machine interaction and establish themselves as a strategic high ground at the forefront of global science and technology. Our research group has focused on addressing critical challenges, including the fabrication processes of high-performance neural microelectrode devices, in situ detection of transient

weak neural signals, and precise localization and regulation with minimal damage. We have proposed fabrication methods for multichannel, dual-mode neural microelectrode arrays and have overcome 38 key common technical challenges, such as the miniaturized and integrated preparation of in vivo dual-mode neural probes. We pioneered a dual-mode in situ detection technology for neural information with high spatiotemporal resolution and high sensitivity, achieving, for the first time internationally, dual-mode synchronous, high-channel, high-spatiotemporal-resolution detection of in vivo neural cells, spanning from devices to systems.

Keynote Speaker

16:30-17:00

Chenjie Xu

City University of Hong Kong

Bio: XU Chenjie is a Professor in the Department of Biomedical Engineering and the Associate Dean of the College of Biomedicine at City University of Hong Kong. His research focuses on the development of microneedle-based biomedical devices for transdermal drug and cell delivery, with applications in disease diagnosis and treatment. His innovative work explores the use of anisotropic porous microstructures, conductive microneedles, and cryomicroneedles to enhance the efficacy and precision of therapeutic delivery. His research findings have been published in leading journals such as Nature Biomedical Engineering, Nature Reviews Bioengineering, Science Advances, Nature Communications, Biomaterials, and ACS Nano. Prof. Xu has received numerous prestigious awards, including the National Science Fund for Distinguished Young Scholars (2024) and recognition as one of Stanford's top 2% most highly cited scientists for multiple years (2024, 2023, 2022, 2011).

Title: Development of Microneedle Devices for Body Fluid Sampling and Biosensing

Abstract: Wearable technologies have emerged as powerful tools for non-invasive health care monitoring, enabling continuous detection of biomarkers to support personalized medicine and disease management. However, most biological biomarkers stay inside tissue and cannot be accessed on the skin surface through simple contact. Microneedle (MN) technology provides a solution for the wearable technologies to sample biofluid, detect biomarkers, and convert the concentrations of biomarkers to electronic signals. This talk provides a comprehensive overview of latest development in our laboratory, highlighting MN design principles, functional integration with microfluidics, microelectronics, as well as the practical applications.

Keynote Speaker

17:00-17:30

Xiaochen Dong

Jiangsu Normal University

Bio: Prof. Xiaochen DONG obtained PhD degrees from Zhejiang University in 2007. In 2012, he joined Institute of Advanced Materials, NanjingTech University as a Full Professor. And in 2022, he was promoted to vice president of Jiangsu Normal University. He has published more than 300 papers, with citation by >40,000 times (H-index~109), edited and published 3 books in English and Chinese. The current research involves biophotonics and bioelectronics, flexible electronics. His scientific achievements have been honored by many prestigious scientific awards in China, including "Ten thousand plan" - National high level talents special support plan (2017), Distinguished Young Scholar of China (2015), National Science Foundation (2015), and so on.

Title: Conductive Hydrogels for Flexible Electronics

Abstract: Hydrogels are 3D crosslinked polymer networks imbibed with a significant amount of water. Because of their natural affiliation with biological tissues, environmental friendless and ionic conductivity, they have recently drawn significant attention as active materials for a range of flexible electronic applications, especially flexible and stretchable sensors. By extending the structural design strategy based on composite materials, which we previously developed, we have demonstrated hydrogel-based multifunctional wearable sensors that can detect various human motions, body temperature, as well as strains and pressures. Two-dimensional carbides and nitrides, also known as MXenes, are a rapidly expanding new family of 2D nanomaterials that have found wide applications in energy storage, electronics, etc. They possess metallic conductivity, superior hydrophilicity and abundant chemical modification opportunities. Therefore, when used as conductive nanofillers in hydrogels, new properties and functions emerge due to complex interactions between MXenes and other constituents within the hydrogel system, leading to dramatically enhanced applications and even brand new ones, as we demonstrated through MXene-hydrogel-based flexible sensors.

Oral Presentation

17:20-17:35	**Paper ID:** Oral# 37 **Paper Title:** Biochemical Sensors in the Clinical Diagnosis of Wound Infections **Presenter:** Ning Tang, Shanghai Jiao Tong University

Technical Sessions

D3-PM-B07: Piezoelectric and Acoustic MEMS

16:00-18:05, April 19, 2026 **Meeting Room 306**

Session Chair: Bin Yang, Shanghai Jiao Tong University

Keynote Speaker

16:00-16:30 **Jin Xie**

Zhejiang University

Bio: Prof Jin Xie received B.Eng. degree from Tsinghua University in 2000, and M.Eng. degree from Zhejiang University in 2003, and the Ph.D. degree from Nanyang Technological University, Singapore in 2008. From 2007 to 2011, he worked in Institute of Microelectronics, Singapore, where he was a scientist in the Sensors and Actuators Microsystems Program. From June 2011 to July 2012, he worked as a post-doc researcher in the Department of Mechanical Engineering, University of California, Berkeley, CA, USA. He was a research member of Berkeley Sensor & Actuator Center (BSAC). In October 2012, he joined School of Mechanical Engineering, Zhejiang University as a full professor. His research interests include MEMS sensors and actuators, wearable devices and flexible sensors. He has published more than 120 journal papers and 80 conference papers, and has been granted 15 Chinese invention patents. He was TPC member of IEEE NEMS 2015, 2018, 2020, 2022 and Transducers 2021. He is an IEEE member, and is an editorial board member of the journal of AI Sensors (MPDI) and the journal of Smart Wearable Technology.

Title: Human-Machine Interaction Based on Piezoelectric Micromachined Ultrasonic Transducers

Abstract: Wearable ultrasonic devices can non-invasively monitor muscle activities for prosthetic hand control and human-machine interaction (HMI). However, most existing ultrasonic probes for deep muscle tissue monitoring are designed with bulky structures, limiting their wearability for long-term continuous monitoring. This talk includes three topics: (1) First, a sensing and controlling strategy is introduced for upper extremity prosthetics through finger motion decoding based on wearable piezoelectric micromachined ultrasound transducer (PMUT). (2) Secondly, a strategy is proposed for simultaneous gesture recognition and upper limb angle measurements using multiple A-mode ultrasonic patches, enabling real-time control of a four-degree-of-freedom (4-DOF) virtual robotic arm. (3) Finally, we present a soft electronic skin (E-skin) for 3D hand reconstruction inspired by human biology, which integrates a multi-sensor fusion of stretchable carbon nanotubes (CNTs) strain sensors and PMUT.

Invited Speaker

16:30-16:50

Bin Yang

Shanghai Jiao Tong University

Bio: Bin Yang is a Professor and Ph.D. Supervisor at the School of Integrated Circuits, Shanghai Jiao Tong University, and was selected for the Shanghai Pujiang Talent Program. He received his Ph.D. from Shanghai Jiao Tong University in 2006. Subsequently, he conducted postdoctoral and research work at the Department of Mechanical Engineering at the National University of Singapore and at the Institute of Microelectronics (IME) Singapore, focusing on MEMS sensors and energy harvesters. He joined Shanghai Jiao Tong University in 2011. Prof. Yang's research interests are primarily in micro/nano self-powered devices and systems, high-temperature sensors, and the synthesis and application of piezoelectric micro/nano materials (e.g., nanowires). As Principal Investigator, he has led numerous national key research projects, including grants from the National Natural Science Foundation of China, the National Science and Technology Major Project, the National Key R&D Program, and the Equipment Pre-research Joint Fund of the Ministry of Education. He has published over 100 SCI-indexed papers in prestigious journals such as Advanced Materials, Advanced Functional Materials, ACS Nano, IEEE Transactions on Industrial Electronics, and IEEE Journal of Microelectromechanical Systems. His publications include 7 ESI Highly Cited Papers and 1 ESI Hot Paper, with an H-index of 56. He has also co-authored two English monographs and serves as an Associate Editor for the SCI journal International Journal of Optomechatronics. He was a recipient of the First Prize of the Natural Science Award from the Ministry of Education in 2015.

Title: Heterogeneously Integrated Flexible Piezoelectric MEMS Sensors and Microrobotics

Abstract: As sensing units continue to be miniaturized, flexible piezoelectric sensor arrays face critical challenges, including reduced sensitivity and aggravated crosstalk effects, despite the pursuit of high spatial and temporal resolution. Therefore, this work focuses on mechanical thinning and heterogeneous integration strategies, and systematically explores key approaches for performance optimization and application expansion of flexible piezoelectric sensors through device structural design and mechanistic investigation. Meanwhile, the ultrathin structural design of the robot is achieved through a high-performance piezoelectric composite film microstructure based on MEMS technology. The robot exhibits various vibration modes when driven by ultrasonic frequency signals, its motion speed reaches 81 cm/s at 54.8 kHz, exceeding that of the fastest piezoelectric microrobots.

Invited Speaker

16:50-17:10

Yuanlin Xia

Sichuan University

Bio: Yuanlin Xia received the Ph.D. degree in micro/nano engineering from Kyoto University, Kyoto, Japan, in 2022. He is an Associate Professor at Sichuan University, specializing in the design, fabrication, and reliability enhancement of high-performance MEMS optical scanning mirrors. His research focuses on silicon micromachining optimization, functional material integration, and robustness engineering for mass-producible micro-optical systems. He has made contributions to achieving low-cost, miniaturized, and highly reliable MEMS mirrors with enhanced scanning performance and environmental stability. His work has been regularly presented at international conferences including IEEE MEMS, Transducers, and IEEE NEMS. His current efforts aim to translate advanced MEMS photonic devices into practical biomedical applications, particularly in ophthalmic diagnostics and human–machine interfaces.

Title: Piezoelectric Mirror and Eye Tracking System

Abstract: Strabismus affects over 10 million individuals in China alone and, if untreated, can lead to amblyopia, postural abnormalities such as scoliosis, and significant psychosocial challenges—particularly in children. Current clinical diagnosis heavily relies on subjective assessments by ophthalmologists, suffering from low reproducibility, limited quantifiability, and poor pediatric compliance. To address these limitations, we present a novel strabismus screening and interactive rehabilitation platform based on MEMS mirror-enabled eye-tracking technology. Our approach integrates a piezoelectric MEMS scanning mirror that enables high-density, high-speed optical raster scanning with minimal footprint. By analyzing the reflected scanning signals, precise ocular movement trajectories are reconstructed in real time, allowing for objective quantification of misalignment angles and binocular coordination. Furthermore, we have developed an engaging, game-based interactive system that not only facilitates automated screening but also delivers personalized visual therapy through adaptive feedback. The entire system demonstrates superior accuracy, miniaturization, and operational efficiency compared to conventional methods, while significantly reducing inter-operator variability. This work bridges advanced MEMS photonics with clinical ophthalmology, offering a scalable, low-cost solution for early detection and home-based rehabilitation of strabismus.

Invited Speaker

17:10-17:30

Zhikang Li

Xi'an Jiaotong University

Bio: Zhikang Li is currently a Professor with School of Instrument Science and Technology, Xi 'an Jiaotong University. He received the Ph.D.degree in mechanical engineering from Xi’an Jiaotong University, Xi’ an, in 2017. From 2014 to 2015, he was with the Group of Prof. Liwei Lin, University of California at Berkeley, Berkeley, CA, USA, as a jointly cultivated Ph.D.

Student. From 2018 to 2020, he worked as an Assistant Researcher with the Group of Prof. Ali Khademhosseini, Department of Bioengineering, University of California at Los Angeles, Los Angeles, CA, USA. His research interests include CMUTs, PMUTs, and flexbiel wearable tactile sensors.

Prof. Zhikang Li has presided over a total of 20 projects, including national key research and development plan projects, general/youth projects of the National Natural Science Foundation of China, etc. He has published in 65 SCI papers in journals such as Science Advances, Advanced Materials, Advanced Functional Materials, Engineering, Microsystem & Nanoengineering, with 4 papers being ESI highly cited. He has also authored 2 chapters in English books and 1 part of undergraduate textbooks, obtained 40 authorized invention patents. Furthermore, he was awarded numerous awards and honors, including the Excellent Doctoral Dissertation Nomination Award from the Chinese Instrumentation and Control Society, the Second Prize of the China Machinery Industry Science and Technology Award, and the Second Prize of the Science and Technology Progress Award from the Aviation Industry Corporation of China.

Title: Design and Application of High-Performance MEMS Ultrasonic Transducers

Abstract: Ultrasonic transducers are widely applied in industrial non-destructive testing and medical imaging. Compared to commercial piezoelectric ceramic ultrasonic transducers, MEMS ultrasonic transducers exhibit prominent advantages such as miniaturization, wide bandwidth, low power consumption, ease of two-dimensional array preparation, and integration with ICs, are expected to be the core components of the next generation of miniaturized, integrated, and intelligent ultrasonic microsystems, promoting the development of emerging fields such as consumer ultrasonic electronics, 3D real-time imaging, ultrasonic health monitoring. This report will share the research progress of our research group over the past fifteen years in the design and application of high-performance MEMS ultrasonic transducers (including capacitive micromachined ultrasonic transducers (CMUTs) and piezoelectric micromachined ultrasonic transducers (PMUTs)), and their innovative application in fields such as aerospace health monitoring and wearable heart health monitoring.

Invited Speaker

17:30-17:50

Bowen Sheng

Peking University

Bio: Bowen Sheng received the Ph.D. degree from Peking University in 2020. He is a Research Assistant Professor with the School of Integrated Circuits, Peking University. His research interests include piezoelectric thin film fabrication, high performance piezoelectric actuators and sensors design and char acterization, and photoacoustic MEMS technology.

Title: ScAlN Based Piezoelectric MEMS for Ultrasonic Sensing

Abstract: This talk presents scandium-doped aluminum nitride (ScAlN) based piezoelectric MEMS for ultrasonic sensing. ScAlN combines enhanced piezoelectric coefficients with CMOS compatibility, making

it a promising material for MEMS integration. A flexible cluster-tool platform enables controlled deposition and etching of ScAlN films with precise scandium concentration and good crystalline quality. Wafer-level characterization confirms good uniformity in thickness, stress, and effective piezoelectric coefficient. Based on this platform, piezoelectric micromachined ultrasonic transducers (PMUTs) are fabricated and applied to broadband ultrasound reception, surface-liquid/ice detection, flow sensing, and self-adaptive microphones. Future work focuses on material quality improvement, stress management, and advanced CMOS-MEMS integration for compact, high-performance sensing systems.

Invited Oral Presenter

17:30-17:50 **Teng Zhang**

University of Cambridge

Bio: Ultrasonic transducers are central to medical imaging, sensing, and wireless bioelectronics, yet conventional single-frequency devices are constrained by inherent physical trade-offs that motivate multi-frequency operation. In traditional ultrasound systems, the operating frequency directly couples spatial resolution with penetration depth: higher frequencies offer finer resolution but undergo stronger acoustic attenuation in tissue, whereas lower frequencies penetrate deeper with reduced imaging detail. These competing requirements make it difficult for a single fixed-frequency transducer to meet the demands of diverse biomedical scenarios.

Multi-frequency Piezoelectric Micromachined Ultrasonic Transducers (PMUTs) have emerged as a powerful approach to address these limitations. By systematically studying the mechanical response of PMUT structures, we have developed both single devices and PMUT arrays that operate at multiple frequencies through structural design and electrode patterning, thereby expanding functional versatility within a compact platform. Tested in multiple biomimicking environments, this multi-frequency capability leads to improved performance across key applications. In photoacoustic imaging, the adoption of multi-frequency PMUT array allows detection across different spectral bands, which enhances image contrast and enables functional characterization of tissue. When combined with a customized neural network, this approach further enables color photoacoustic imaging. In pulse-echo ultrasound characterization, it allows adaptive operation that balances resolution and penetration depth in real time. For implantable devices, multi-frequency PMUTs enable simultaneous wireless power transfer and data telemetry on separate channels, improving efficiency and link reliability while reducing overall system size.

Technical Sessions

D3-PM-B08: Micro/Nano Energy Devices and Self-Powered Systems

16:00-17:20, April 19, 2026 **Meeting Room 307**

Session Chair: Zhen Wen, Soochow University

Invited Speaker

16:00-16:20 **Lei Yang**

Xi'an Jiaotong University

Bio: Lei Yang is a Professor and PhD Supervisor at the School of Mechanical Engineering, Xi’an Jiaotong University. His research focuses on intelligent sensing technologies, solid–liquid triboelectric nanogenerators, self-powered sensor systems, flexible and wearable electronic devices, equipment condition monitoring, and novel robotic structure design. He has made sustained contributions to the fundamental mechanisms of interfacial triboelectrification and to the development of integrated sensing systems for complex mechanical and energy-related environments, with applications in lubrication monitoring, structural health assessment, and human–machine interaction. Prof. Yang has authored and co-authored more than 50 peer-reviewed journal papers published in leading international journals, including Advanced Functional Materials, npj Flexible Electronics, Nano Energy, and Nano-Micro Letters. His research outcomes have been recognized with multiple awards, including the Second Prize of the Shaanxi Provincial Natural Science Award and the First Prize of the Shaanxi Higher Education Science and Technology Award.

Title: Solid–Liquid Two-Phase Flow Electrification: Mechanisms and Intelligent Liquid Parameter Monitoring

Abstract: Liquid-state parameters provide critical information for assessing system performance, reliability, and safety in aerospace equipment, marine environments, industrial processes, and medical diagnostics. However, real-time monitoring of complex liquids remains challenging due to the strong coupling between liquid dynamics, interfacial charge transfer, and multiphase composition. Solid–liquid triboelectric nanogenerators (TENGs) have emerged as promising self-powered sensing platforms, yet their signal generation mechanisms and reliability under complex fluid conditions are not fully understood, limiting their quantitative sensing capability and practical deployment. In this work, we systematically investigate the electrification mechanisms of solid–liquid interfaces and develop intelligent liquid parameter monitoring methods based on triboelectric signals. First, the dynamic coupling between droplet deformation and triboelectric output is elucidated by combining high-speed imaging, synchronized electrical measurements, and multiphysics modeling. A unified framework is established to correlate droplet spreading, rebound, and sliding behaviors with time-resolved electrical responses, enabling stable and enhanced signal generation. Second, for particle-laden liquids, a

dual-source electrification mechanism involving solid – liquid and solid – solid interactions is revealed, allowing quantitative interpretation of multiphase signal features. Third, a triboelectric – capacitive dual-mode sensing strategy is proposed to exploit the complementary sensitivity of interfacial dynamics and bulk dielectric properties, significantly improving parameter decoupling and robustness in complex fluids. Finally, physics-informed deep learning models are introduced to achieve intelligent identification of liquid composition and concentration under variable operating conditions.

Invited Speaker

16:20-16:40

Junyi Zhai

Beijing Institute of Nanoenergy and Nanosystems, CAS

Bio: Junyi Zhai is a professor of the Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences. His research mainly engaged in the preparation of piezoelectric semiconductor materials, the growth and characterization of epitaxial functional oxides, the design and application of novel multifunctional electronics and optoelectronics devices, self-powered sensors, and the Ocean Internet of Things. So far, he has published more than 180 research papers in journals such as Science Advances, Nature Communication, Matter, Chemical Review, and Advanced Materials, with over 15000 citations. The H-index of these paper is 58, and he has obtained 10 invention patents. He has PI or Co-Pi 4 projects from the National Natural Science Foundation of China and the Ministry of Science and Technology of the People's Republic of China.

Title: High-Efficiency Hybrid Nanogenerators for Self-Powered Marine Monitoring Systems

Abstract: The expansion of marine monitoring demands robust, self-sufficient power solutions. Our research addresses this by pioneering a suite of highly coupled triboelectric – electromagnetic hybrid nanogenerators (TE-HNGs) for superior wave energy harvesting. We have developed innovative architectures — including magnetic suspension (MS-HNG, ML-HNG), swinging structure (MS-HNG, S-TENG), and pendulum-coupled (CP-CNG) designs—that achieve exceptional spatial efficiency (up to 91.9%), durability (>240k cycles), and a multi-frequency response to low-frequency waves.

Central to our success is the synergistic interplay between structural design and intelligent power management. Circuits like the universal power management system (UPMS), dual-track circuit (DTC) and energy self-managed power system (ESPS) harness phase coherence between generator units to orchestrate energy release, transforming device output. The ESPS achieves a peak power of 261.3 mW, a significant improvement over 75.5 mW from the MS-HNG alone, illustrating a synergistic effect where 1+1>2.

These integrated systems power practical applications directly, from multi-sensor arrays to long-range (1.5 km) LoRa wireless transmission, enabling real-time, self-powered marine meteorological and water quality monitoring. Our work establishes a comprehensive framework from fundamental generator coupling to system-level integration, marking a significant stride toward the commercialization of blue energy technology.

Invited Speaker

16:40-17:00

Lindong Wu

Southeast University

Bio: Lindong Wu is an Associate Professor at Southeast University, a Xiaomi Youth Scholar, and the master's supervisor. He received his B.Sc. degree in 2017 and Ph.D. degree in 2022 from Peking University. He was then supported by the Boya Postdoctoral Fellowship of Peking University. In September 2024, he joined the School of Integrated Circuits, Southeast University. His research mainly focuses on memristors, energy devices, energy-information integration, and neuromorphic computing. Lindong Wu is currently leading three research projects and has published 29 papers in high-impact international journals and conferences such as IEDM, Science China Information Sciences, IEEE TED, and Advanced Electronic Materials, among which 14 are as first author or corresponding author.

Title: Research on Energy–Information Integrated Application Based on Supercapacitors

Abstract: Driven by the More than Moore strategy, the integrated circuit technology is gradually moving towards microsystems integrating multiple functions. Supercapacitors, featuring prominent advantages of miniaturization, integration, high safety, and high energy density, have become an ideal power supply solution for microsystems. However, energy supply remains a key bottleneck restricting the development and practical application of high-performance microsystems. To address this critical issue, in-depth research has been carried out, and a series of important research achievements have been obtained.

We successfully realized the preparation and optimization of miniaturized lithium-ion supercapacitors. On this basis, we achieved monolithic integration of one-supercapacitor-one-optoelectronic memristor array, which can effectively realize in-situ enhancement of images and lossless encryption of image information, providing a reliable self-powered technical support for intelligent sensing systems. Meanwhile, a monolithic integrated microsystem based on supercapacitors was established, which effectively achieves controllable sensing performance, laying a solid foundation for the functional integration of microsystems. Finally, the 3D integration of memristors was explored, which is of great significance for further integrating energy storage, sensing, and computing functions, and provides a solid technical basis for the subsequent construction of self-powered intelligent microsystems. These research results are expected to break through the energy bottleneck of microsystems and promote the integrated development of microsystem technology in the field of energy-information integration.

Invited Speaker

17:00-17:20

Wenbin Kang

City University of Hong Kong

Bio: Prof. Wenbin Kang is an Assistant Professor at City University of Hong Kong and a Visiting Fellow at the University of Oxford. He holds a Bachelor's and a Master's degree from Shanghai Jiao Tong University, a DPhil from the University of Oxford, and served as a Marie Curie Postdoctoral Fellow at the Max Planck Institute for Intelligent Systems in Germany. His long-term research focuses on piezoelectric and ferroelectric materials, energy harvesting and storage, artificial intelligence, micro-robotics, biomedical applications, and related fields. He has published over 20 SCI-indexed papers in internationally renowned journals such as Nature, Nature Machine Intelligence, Science Advances, Nano Energy, and Cell Reports Physical Sciences. He holds one authorized Chinese national invention patent and has one international patent application pending. Additionally, he serves as a Youth Editorial Board Member for journals including SmartBot and Soft Science, and acts as a reviewer for journals such as Nature Communications and Science Advances.

Title: Analysis and Design of High-Performance Energy Harvesting Devices

Abstract: Given the substantial issues of environmental pollution and inconvenience associated with batteries, energy harvesting has become an attractive alternative or supplement, with mechanical energy harvesting by piezoelectrics being a prominent technology. However, piezoelectric energy harvesters cannot meet growing energy demands as a result of their low power density, despite the efforts of numerous researchers to enhance performance. A mathematical model of the energy structure was developed based on the Euler – Bernoulli beam theory, assuming a long, slender, and shallow beam geometry. This model is then integrated with the electrical energy harvesting circuit, where the electrical response of the piezoelectric material is used to complete the circuit analysis. The model serves as the foundation for parametric optimization over geometric and electrical design variables, including the thicknesses of the piezoelectric, adhesive, and substrate layers (hp, ha, hs), their lengths (lp, ls), the beam width (w), and the circuit resistance (Rc). Instead, ferroelectric/ferroelastic switching, with greater flows of charge and energy, may offer a viable alternative. In this respect, ferroelectric/ferroelastic switching is attractive because of the greater energies and charge flows involved. However, the associated nonlinearities and the difficulty of establishing a stable working cycle have prevented significant progress. In this work, a robust ferroelectric energy harvester based on partial ferroelectric switching is explored. The device is of simple construction and achieves a per-cycle energy density of about 1 mJ cm−3, orders of magnitude greater than that of typical piezoelectrics. It is shown that only periodic compressive stress is needed to induce the energy harvesting cycles, yielding promising mechanical attributes that limit fatigue or fracture during cyclic loading.

Technical Sessions

D3-PM-B09: Nanodevice Physics

16:00-17:20, April 19, 2026 **Meeting Room 308**

Session Chair: Shenghai Pei, University of Electronic Science and Technology of China

Invited Speaker

16:00-16:20

Jiamin Quan

Tongji University

Bio: Jiamin Quan is a Professor in the School of Physical Science and Engineering at Tongji University. He received his Ph.D. through a joint training program between Chongqing University and University of Texas at Austin. He subsequently conducted postdoctoral research at the Department of Physics and the Department of Electrical and Computer Engineering at University of Texas at Austin, as well as at the Advanced Science Research Center at the City University of New York. He joined Tongji University in July 2024.

His research focuses on two-dimensional materials, nanophotonics, and their hybrid systems. He has published 35 papers in leading journals including Nature, Nature Materials, and Nature Photonics.

Title: Unveiling Dark Excitons in Monolayer Semiconductors with Plasmonic Nanocavities

Abstract: Dark excitons in atomically thin van der Waals materials provide an exciting platform for information transport and nanophotonic applications. While they are difficult to access through free-space radiation, hybrid heterostructures incorporating plasmonic nanocavities provide a powerful platform to tailor interactions between dark excitons and photons. Here, we use a carefully designed heterostructure consisting of optimized plasmonic nanocubes coupled to a WSe2 monolayer encapsulated between thin hBN layers to unveil a new family of dark excitons, never observed to date. The emission from these dark excitons is found to be 2,700 times stronger than bright excitons, yielding a striking enhancement factor of 3 × 10^5. We demonstrate the spin-forbidden nature of these dark states by studying their magneto-optical response. Furthermore, we selectively activate them by controlling the Fermi level via electric doping. Prominent features of this family of dark excitons include narrow linewidths, long lifetime, efficient electrical and magnetic modulation. Our findings unlock the potential for exploring novel exciton physics in 2D materials using photonic heterostructures that preserve the intrinsic optical properties of 2D materials in the coupling process. The demonstrated on-site control and ease of integration with passive photonic components make this platform particularly compelling for nanophotonic and sensing applications.

Keynote Speaker

16:20-16:50

Kai Liu

Tsinghua University

Bio: Prof. Kai Liu obtained his B.S. in applied physics at Xi'an Jiaotong University and Ph.D. in physics at Tsinghua University. After postdoctoral research at Lawrence Berkely Lab and UC Berkeley, he joined the School of Materials Science and Engineering at Tsinghua University in 2015 and was promoted to a full professor in 2025. His research relates to interface engineering of 2D materials for intelligent electronic devices. Prof. Liu has published more than 150 papers in leading journals including Science, Nature Synthesis, Nature Electronics, etc., and had more than 60 authorized patents. He served as an Academic Associate Editor of Rare Metals, and member of young scientist committee of Nano Research, InfoMat, and SmartMat. His main awards include the First Prize of Science and Technology Award of Chinese Materials Research Society (2020, 2024), the IUMRS Young Scientist Award (2022), and the Excellent Doctoral Dissertations in China (2010).

Title: Doping Engineering of 2D Materials for High-Efficiency Neuromorphic Devices

Abstract: The rapid development of modern information technology and artificial intelligence requires nanoelectronic devices to possess high integration and multiple functions, and in many cases, to adapt to complex operating environments. It is thus imperative to develop high-efficiency neuromorphic nanodevices that feature low structural complexity, multifunctionality, and low energy consumption. Two-dimensional (2D) van der Waals (vdW) materials have atomic thickness, dangling-bond-free surface, and a variety of band structures, thus holding the potential to break physical limitations and generate revolutionary device principles and technologies. In this report, the speaker will present some recent studies on the doping engineering of 2D materials (e.g., MoS2 and MoTe2) for high-efficiency neuromorphic devices, including memristors, synaptic transistors, and reconfigurable devices. Through these studies, it is hoped that new ideas will be uncovered for the development of novel nanoelectronic materials and devices.

Invited Speaker

16:50-17:10

Cheng Zhang

Fudan University

Bio: Dr. Cheng Zhang received his B.Sc. (2014) and Ph.D. (2019) in Physics from Fudan University, complemented by a joint Ph.D. program at the University of Washington (2017 – 2018). In 2019, he joined the Institute for Microelectronics and Quantum Computer Systems at Fudan University as an Assistant Professor, and was promoted to Professor in 2022. Dr. Zhang has been selected for several competitive talent programs, including the National High-level Talent Program (Youth Top-notch Talent), the Shanghai Oriental Talent Program, and the Shanghai Shuguang Scholar. He currently serves as Principal Investigator for a Young Scientist Project under the National Key R&D Program, as well as

projects supported by the Major Research Plan and General Program of NSFC. His research centers on quantum transport phenomena in low-dimensional systems, acoustoelectric effects, and novel electronic devices. He is recognized for pioneering contributions such as the discovery of three-dimensional quantum Hall effects based on Weyl orbits, ultrahigh conductivity of topological Fermi arcs, and oscillating acoustoelectric effects. Dr. Zhang has authored more than 50 publications in leading international journals, including Nature, Nature Materials, Nature Reviews Physics, and Physical Review Letters.

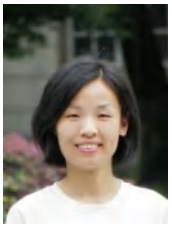
Title: Developing Acoustoelectric Transport Techniques for Low-Dimensional Materials and Devices

Abstract: Surface acoustic waves (SAW) couple with charge carriers via piezoelectric fields, enabling highly sensitive control and detection of charge transport in low-dimensional quantum systems. In recent years, focusing on the application of acoustoelectric effects in low-temperature and high-magnetic-field conditions, we have systematically developed new methods for characterizing quantum transport based on on-chip SAW devices, achieving significant progress in low-dimensional quantum systems and moiré superlattice systems. Using on-chip SAW devices, we realized steady-state acoustoelectric voltages generated by the directional motion of carriers dragged by acoustic waves, observing their sensitivity to propagation direction and acoustoelectric Hall responses under magnetic fields. Combined with gate voltage and magnetic field tuning, this method can precisely characterize quantum oscillations, Landau quantization, and Fermi surface structures. Furthermore, through pulsed coherent acoustic probing, we observed oscillatory acoustoelectric effects driven by acoustic fields, extracting key dynamic parameters such as carrier relaxation times and acoustoelectric coupling strengths. On another front, utilizing high-Q SAW resonators to measure acoustic attenuation and changes in sound velocity, we achieved non-contact high-frequency detection of quantum phases such as correlated insulating states, Landau levels, and Chern insulating states in moiré superlattice systems, revealing their frequency-dependent conductivity and incompressible state characteristics. The acoustoelectric technology developed in this study enables sensitive characterization of Fermi surfaces, carrier dynamics, and correlated quantum phases in low-dimensional quantum materials under magnetic fields, providing a new technological platform for exploring frontier areas such as topological states and correlated phenomena.

Invited Speaker

17:10-17:30

Zejuan Zhang



University of Electronic Science and Technology of China

Bio: Zejuan Zhang is currently a post doctor at University of Electronic Science and Technology of China (UESTC). She received her Bachelor's and Master's degrees at Chongqing University and the Ph.D. degree in Electronic Science and Technology from University of Electronic Science and Technology of China in 2024. And then she joined Institute of Fundamental and Frontier Sciences. Her main research field involve two-dimensional materials and related physical properties. Specifically, she has been active in the study of interlayer coupling effect in 2D materials and heterostructures under extreme conditions such as high pressure. Dr. Zhang has published more than 10

peer-reviewed papers (Reports on Progress in Physics, Applied Physics Reviews, Science China Physics Mechanics & Astronomy, National Science Review, Microsystems & Nanoengineering etc.), led 2 open research project funded by a national key laboratory, and as a key project member, participated in various national research initiatives, including key intergovernmental projects under the National Key R&D Program, the Joint Fund of the National Natural Science Foundation of China, and the Original Exploration Program of the National Natural Science Foundation of China.

Title: Dynamic Strain Engineering and Lattice Modulation in Two-Dimensional WSe2 Nanoelectromechanical Systems

Abstract: Two-dimensional nanoelectromechanical systems (NEMS), owing to their atomically thin vibrating structures, can generate significant tensile strain and vertical displacement at the nanoscale. This provides an ideal platform for exploring dynamic strain engineering and cross-scale vibrational coupling in two-dimensional materials. This paper utilizes the WSe2 NEMS, a device structure with mechanical degrees of freedom, to investigate the physical properties of two-dimensional WSe2 and achieve its dynamic control. Through MHz electrical excitation, we effectively modulate the terahertz (THz) atomic lattice vibrations. Furthermore, both THz atomic lattice vibrations and MHz nanomechanical vibrations are explored in the two-dimensional WSe2 material, enabling the dynamic control of quasiparticles (excitons or phonons) through mechanical vibrations. The study focuses on the cross-scale dynamic coupling between atomic lattice vibrations and nanomechanical resonance in few-layer WSe2 NEMS.

Technical Sessions

D3-PM-B10: 3D Printing and Bioprinting

16:00-18:20, April 19, 2026 **Convention Hall A**

Session Chair: Zhuo Xiong, Tsinghua University

Keynote Speaker

16:00-16:30 **Zhuo Xiong**

Tsinghua University

Bio: Zhuo Xiong is a full professor at Tsinghua University. He currently serves as the director of the Beijing Key Laboratory of Intelligent Organ Biofabrication and Regenerative Repair, and vice chairman of the Biofabrication Engineering Committee of the Chinese Mechanical Engineering Society. His research focuses on 3D bioprinting, regenerative engineering, digital information storage in DNA and additive manufacturing.

He has published over 100 papers in journals including Cell Biomaterials, Nature Communications, Advanced Materials, Advanced Science and Materials Today, with more than 4,000 citations and an H-index of 41. He holds over 30 authorized invention patents, with multiple technologies commercialized and two products entering clinical trials. He serves on the Editorial Board of the journals Bio-Design and Manufacturing and Journal of Polymer Materials. He has received awards such as the International Invention Exhibition Award of Geneva, China Machinery Industry Science and Technology Award, and Beijing Science and Technology Award.

Title: Biomanufacturing Technologies in Organ Reconstruction

Abstract: Since 2005, the team of the Biomanufacturing Center of the Department of Mechanical Engineering at Tsinghua University has established a theoretical and technical framework system for biomanufacturing engineering based on the controlled assembly of cells. A technical route for constructing tissues and organs through the direct and indirect controlled assembly of cells has been proposed. In-depth research work has been carried out in three aspects: bioinks and process equipment for 3D cell printing, additive manufacturing technologies for bionic multi-scale tissue engineering scaffolds, and strategies and methods for constructing complex organs inspired by the organ development process. In 2023, based on the microsatellite platform, the team pioneered the space biological 3D printing of complex tumor models. The talk will introduce the team's exploration and innovation in the field of biomanufacturing technology over the past two decades.

Keynote Speaker

16:30-17:00

Maling Gou

Sichuan University

Bio: Dr. Maling Gou is a professor in the State Key Laboratory of Biotherapy, West China Hospital, West China Medical School, Sichuan University, China. His research mainly focuses on bioprinting and biomaterials for biotherapy. He got his PhD from Sichuan University (China) in 2010 and worked as an assistant professor in Sichuan University. He worked as a visiting scholar in UC San Diego since 2012 for 1 year. He was promoted to be a professor in 2017 in Sichuan University. He has developed digital light processing (DLP)-based 3D printing technologies and biomaterials-enabled or -improved therapeutics for potential application in cancer treatment and tissue regeneration. Dr. Gou has published over 130 academic papers in various international journals and has been selected as the associate editor and editorial board member for some international academic journals, such as International Journal of Bioprinting, International Journal of Nanomedicine, Burns & Trauma, Bio-design & Manufacturing. Now, he is the Chairman of 3D Printing Technology Branch of the China Medical Biotechnology Association (CMBA) and the Vice-Chairman of Disease Model Technology Branch of the CMBA.

Title: 3D-Printing of Tumor Organoid Chips

Abstract: Tumor organoids can faithfully recapitulate the histological features and individual heterogeneity of tumors, demonstrating significant potential in anticancer drug development and precision medicine screening. However, current organoid culture systems largely rely on Matrigel, whose xenogeneic origin, complex composition, and batch-to-batch variability may compromise the reproducibility and stability of organoids. In addition, its dense network may hinder the interaction between biomacromolecules, cells, and other biotherapeutics with organoids, thereby severely limiting organoid model construction and their application in biotherapeutic screening. In this study, to address the limitations of conventional Matrigel-based methods in organoid culture and biotherapeutic evaluation, we 3D printed a “Matrigel-free” organoid chip with nested microporous array structures. This platform overcomes the matrix barrier to the delivery of biomacromolecules and cells, thereby enhancing the interaction efficiency between biotherapeutics and organoids. This work provides a technological platform for the efficient screening of biotherapeutics.

Invited Speaker

17:00-17:20

Liang Ma

Zhejiang University

Bio: Liang Ma, Associate Professor at the School of Mechanical Engineering, Zhejiang University, and Visiting Scholar at the University of Cambridge. He obtained his Ph.D. from Mechanical Engineering Department in University of Washington in 2012. His research include the use of 3D bioprinting technology, micro nano biomanufacturing technology, and microfluidic chip technology to accurately construct in vitro pharmacological models

of diseases, and to conduct a series of new biomedical diagnostic and therapeutic methods such as drug delivery micro nano robots and disease drug screening chips. He has completed the world's first 3D micro nano structure printing in suspended living cells. He has published more than 80 high-level SCI papers including Advanced Materials, Biomaterials, Bioactive Materials, International Journal of Extreme Manufacturing, Engineering and have been cited more than 3800 times. He served as the Deputy Director of the editorial office for the journal Bio-Design and Manufacturing. （JCR Q1, IF=7.6）.He serves as a committee member of multiple societies and industry associations, including the standing committee member of Organoids and Organ- on-Chip Branch of the Chinese Society of Biomedical Engineering. Authorized over 20 invention patents and won one gold medal at the 2022 Geneva Invention Exhibition.

Title: Micro/nano Biomanufacturing

Abstract: Micro/nano biomanufacturing is a cutting-edge interdisciplinary field that integrates micro/nano manufacturing technology in biomedicine. It is committed to designing, processing, and constructing structures, devices, or systems with biological functions at the micrometer to nanometer scale, and is widely used in biomedical, tissue engineering, drug development, and precision medicine. We have successfully constructed vascularized liver tissue models and liver fibrosis models, microfluidic circulating tumor cell capture chips using advanced additive manufacturing technologies such as suspension extrusion printing, two-photon polymeration(TPP), and volumetric 3D printing. We have completed the world's first micro nano three-dimensional structure manufacturing in suspended living cells. This provides a new manufacturing method for the construction of in vitro pharmacological models and the development of precision biomedicine.

Invited Speaker

17:20-17:40

Gang Li

Soochow University

Bio: Prof. Gang Li is currently a full professor at the National Engineering Laboratory for Modern Silk, Soochow University, China. Dr. Li received his Ph.D. in Biomedical textiles and Engineering from the Hong Kong Polytechnic University. He is a visiting professor of Tufts University, USA (Prof. David Kaplan’s team). Dr. Li published over 100 academic articles and issued 50 patents between 2006 and 2024. Dr. Li presented talks, organized symposia and workshops at various international scientific conferences. His research interests focus on biomedical materials, functional and smart textiles by combining of materials, biomedical and textile engineering.

Title: R&D of 3D Printing Technology in Silk-based Biomaterials

Abstract: Amongst the variety of biomaterials used, silk-based biomaterials (SBBs) have been widely used clinically viz. sutures for centuries and are being increasingly recognized as a prospective material for biomedical textiles. The ease of processing, controllable degradability, remarkable mechanical properties and biocompatibility have prompted the use of SBBs for various Biomedical textiles and implants for extracorporeal implants, soft tissue repair, healthcare/hygiene products and related needs. This talk

presents a multifunctional silk fibroin (SF) lifting thread and a tri-layered drug-eluting scaffold with macroporous and bamboo-joint bionic structure fabricated using 3D printing method.

Invited Speaker

17:40-18:00

Jiebo Li

Beihang University

Bio: Li Jiebo earned his B.S. and M.S. from Peking University and his Ph.D. from Rice University. He is now a tenured Associate Professor and Principal Investigator in the School of Biological Science and Medical Engineering at Beihang University. His research focuses on light–matter interactions and their medical applications on 3D printing. He has been honoured as a Xiaomi Young Scholar and received the Tianjin Municipal Science and Technology Progress Award (First Prize).

Title: Polar-Coordinate Manufacturing for Medical Devices

Abstract: This study develops two polar-coordinate-based volumetric additive manufacturing (VAM) technologies. First, Polar-coordinate Line-projection Lithography (PLLP) enables multi-material tubular structure fabrication with 50 μm wall thickness and 10 μm feature size via synchronized rotation-translation motion, achieving centimeter-scale tubular grafts in 100 seconds. Second, Sparse-View Irradiation Processing VAM (SVIP-VAM) adopts an optimized odd-even alternating projection strategy inspired by sparse-view CT, reducing projections to 15 (vs. hundreds) with 60× efficiency gain and 10× computation time reduction. These techniques offer promising solutions for high-precision biomedical manufacturing.

Invited Speaker

18:00-18:20

Maobin Xie

Guangzhou Medical University

Bio: Dr. Maobin Xie has received his PhD degree from The Hong Kong Polytechnic University, Hong Kong, China in 2016. From 2019 to 2021, he works as a Postdoc Research Fellow at the Harvard Medical School, Boston, USA. His research interests include 3D bioprinting, volumetric printing and biomaterials. Currently, he has published more than 55 academic papers including Science Translational Medicine , Nature Communications, Nature Protocols, etc.

Title: Volumetric Bioprinting of Artificial Skin

Abstract: Volumetric (bio)printing (VBP) enables fast photopolymerization of three-dimensional constructs by illuminating dynamically evolving light patterns in the entire build volume. However, the lack functional bioinks suitable for VBP is a critical limitation. Here, we report rapid volumetric (bio)printing of natural, unmodified silk-based (silk sericin (SS) and silk fibroin (SF)) (bio)inks and decellularized extracellular matrix (dECM)-based (bio)inks to form sophisticated shapes and architectures within tens of seconds. Further, we present multi-material and multi-cellular VBP for artificial skin.

Technical Sessions

D3-PM-B11: Award Finalist Session: Best Student Paper

16:00-18:00, April 19, 2026 **Convention Hall F**

Session Chairs: Yongliang Yang, SIA, CAS; Zhen Wen, SUDA

16:00-16:15	**Paper ID:** Oral# 165 **Paper Title:** High-Performance Bi2O2Se Field Effect Transistor Fabrication Using Thermal Scanning Probe Lithography **Presenter:** Zeming Jin, Beijing Institute of Technology
16:15-16:30	**Paper ID:** Oral# 180 **Paper Title:** Reconfigurable Flexible Strain Sensor Enabled by a Phase-Transition Mechanical Substrate **Presenter:** Taiqi Hu, University of Electronic Science and Technology of China
16:30-16:45	**Paper ID:** Oral# 226 **Paper Title:** An I-Beam-Coupled Distributed Lamé-Mode Capacitive Resonator with High f × Q Product **Presenter:** Hao Yu, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences
16:45-17:00	**Paper ID:** Oral# 285 **Paper Title:** A Scalar Hydrophone for Low-Frequency Detection Integrated with Compressed Air Spring Based on Electrochemical Transduction Principle **Presenter:** Chuangyi Zheng, Aerospace Information Research Institute, University of Chinese Academy of Sciences
17:00-17:15	**Paper ID:** Oral# 303 **Paper Title:** The Chemically Sensitive Transistor Based on Palladium Nanoparticle-Modified H-BN/MoS2 Heterostructures for H2 Detection **Presenter:** Zhizhi Wang, Huazhong University of Science and Technology
17:15-17:30	**Paper ID:** Oral# 305 **Paper Title:** Determination of Complex Refractive Indices in Ultrathin 2D Materials via Thickness-Dependent Optical Contrast **Presenter:** Ziluo Su, University of Electronic Science and Technology of China
17:30-17:45	**Paper ID:** Oral# 309 **Paper Title:** Design and Fabrication of Flexible Lead-Free PMUTs via KNN-on-SU-8 Heterogeneous Integration **Presenter:** Zimeng Zhang, Xi'an Jiaotong University
17:45-18:00	**Paper ID:** Oral# 344 **Paper Title:** Experimental Realization of Ta2O5-Based All-Solid-State Lithium-Ion Battery with High-Temperature Stability **Presenter:** Rui Meng, Southeast University

Technical Sessions

D3-PM-B12: Micro/Nanomechanical Inertial Sensors

16:00-17:30, April 19, 2026 **Convention Hall C**

Session Chair: Jiangkun Sun, National University of Defense Technology

D3-PM-B12: Micro/Nanomechanical Inertial Sensors

16:00-17:30, April 19, 2026 **Convention Hall C**

Session Chair: Jiangkun Sun, National University of Defense Technology

Keynote Speaker

16:00-16:30

Tianling Ren

Tsinghua University

Bio: Ren Tian-Ling is currently a Professor at the School of Integrated Circuits, Tsinghua University, a specially appointed professor under the Chang Jiang Scholars Program of the Ministry of Education. He serves as the Associate Dean of the School of Information Science and Technology, Tsinghua University. Professor Ren's research team has long been dedicated to the study of intelligent micro-nano electronic devices, chips, and systems, covering intelligent sensors and intelligent integrated systems, two-dimensional nanoelectronic devices and chips, flexible wearable devices, chips and systems, and intelligent information device chips and system technologies. They have published over 900 papers in domestic and international academic journals and conferences, including papers in important SCI-indexed journals such as Nature, Nature Electronics, Nature Machine Intelligence, Nature Communications, Science Advances, IEEE Electron Device Letters, and IEEE Sensors Journal, as well as 17 papers at IEDM. Prof. Ren has been recognized as a "Highly Cited Chinese Researcher" by Elsevier and his work has received over 30,000 citations on Google Scholar, and they have been granted more than 200 domestic and international invention patents.

Title: Flexible Microelectronic Device Technology

Abstract: Flexible microelectronic device technology is one of the important application-driven technology routes within the "More than Moore" development paradigm. It is expected to further expand the application of micro/nano electronic devices in products that have not yet been intelligently transformed, and to provide a technical foundation for building human-machine integrated intelligent systems. However, to realize the industrial value of flexible microelectronic devices, significant room for improvement remains in the development of related materials, processing methods, and system integration technologies. This talk will first introduce the current state of flexible microelectronic device technology, the key challenges it faces, and potential solutions. Then, it will focus on the efforts made by

our team to respond these challenges, with an emphasis on high-performance edge-intelligent flexible AI chips and flexible wearable devices for intelligent human-machine interaction and healthcare applications.

Invited Speaker

16:30-16:50

Fang Chen

Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences

Bio: Fang Chen is currently a researcher at Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences. He received the received the B.S., M.S., and Ph.D. degrees in mechanical and electronic engineering from Northwestern Polytechnical University (NPU), Xi' an, China, in 2006, 2009 and 2014. In 2014, he was awarded with the postdoctoral Professorship by the University of California, Irvine. And then he joined Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS). His research field covers the micro/nano gyroscopes & accelerometers technology, and especially its application for tactical- & industrial-grade.

Fang Chen has published 2 scientific books, more than 20 peer-reviewed papers (Microsystems & nanoengineering, IEEE J. MEMS、IEEE Sensors J., JMM, etc.) and contributed over 5 conference talks (MEMS, Inertial, etc.), and authorized 15 invention patents. In recognition for his research accomplishment, Fang Chen won 3 academic & technological innovation awards, including 2023 Shanghai Science and Technology Progress Awards; and participated in establishing 2 industrial standards. He also served as Shanghai Inertial Council Member and referee for several highly-reputable journals (Microsystems & nanoengineering, IEEE J. MEMS, JMM, etc.). Fang Chen serves as Associate Editor for microelectronics since January 2026.

Title: A Mechanically Amplified Quad-Mass Gyroscope With Parametric Modulation For Offset Drift Cancellation

Abstract: This work presents a novel rhombus-like compliant mechanical amplification concept for silicon micro-machined resonant quadruple mass gyroscope (QMG) to improve its performance with an active area of 3×4 mm2. The scheme is implemented using a system of rhombus-type compliant amplifiers as a deflection amplifying mechanism. This result in a larger Coriolis deflection and a higher signal-to-noise ratio (SNR) compared to conventional QMG. It also has the supplementary benefit to reduce the energy leakage from drive mode to sense mode. The electronics interface is based on a new anti-aliasing multi-bit force-feedback control loop that reduces the offset and drift. This is achieved by parametric modulating of the fabricated QMG and nulling the offset via a cancellation loop. Experimental results demonstrated that the proposed technique results in predicted mechanical amplification and offset drift In-run cancellation.

Invited Speaker

16:50-17:10 **Kai Zeng**

National University of Defense Technology

Bio: Graduated with a Ph.D. from National University of Defense Technology in 2024, he has been engaged in research on new optically levitated gyroscopes and precision trimming of vibration gyroscopes, and has obtained the National Postdoctoral Research Funding Program. The newly developed optically levitated gyroscope is an international initiative, opening up a brand-new path for the development of next-generation ultra-high-precision gyroscopes. This work was published as a cover paper in the national leading journal Microsystems & Nanoengineering. Meanwhile, he has published several papers in journals such as Int. J. Mech. Sci., Optics Express (OE), Optics Letters (OL), among which 8 are first-authored SCI/EI academic papers, and 4 national invention patents have been authorized.

Title: Research on Influencing Factors and Improvement Methods of Bias Stability of Optically Levitated Gyroscope

Abstract: Levitated optomechanical systems use lasers to levitate micro- and nano-particles, and combine quantum optomechanics with classical mechanical dynamics to study the motion laws of particles such as translation, rotation, and precession, deriving ultra-precise measurement capabilities for micro-forces, micro-torques, accelerations, etc. Optically levitated microsphere rotors have also attracted considerable attention in the field of gyroscopes due to their ultra-high rotation speed of hundreds of millions of revolutions per second, extremely low noise torque, and the ability to actively suppress thermal motion. Although a prototype of the optical levitated gyroscope has been developed (with a performance of approximately 300 degrees per hour), research on improving the performance of this type of gyroscope has just begun, aiming to address its bias stability which is far less than expected. Based on the working mechanism of the optical levitated microsphere rotor gyroscope, this report introduces the influence laws of the centroid and torsional pendulum thermal motion of the levitated microsphere on the gyroscope performance, and theoretically calculates the ultimate precision after laser cooling (reaching 10^{-9} degrees per hour). Meanwhile, it presents our latest progress in the field of optical levitated gyroscopes.

Invited Speaker

17:10-17:30 **Chengxin Li**

KU Leuven

Bio: Chengxin Li is currently a postdoctoral research fellow of University of Michigan (Umich). He received Ph.D. degree in Electrical Engineering from KU Leuven, Leuven, Belgium, in 2025, and M.Sc. degree from Huazhong University of Science and Technology, Wuhan, China, in 2021. His current research interests include MEMS oscillators, multi-mode sensors, and MEMS inertial sensors. Dr. Li has published more than 12 peer-reviewed papers (JMEMS, IEEE EDL, IEEE TED, etc.) and contributed over 12+ conference proceedings (MEMS, TRANSDUCERS, IFCS, etc.). He also served as session chair for IEEE NEMS 2026, and referee for several highly-reputable journals (JMEMS, IEEE

TIE, etc.).

Title: Tunable Noise Correlation for Resolution-Enhanced Fusion in a Dual-Mode Resonant Accelerometer

Abstract: Signal fusion has been widely explored to improve the resolution and robustness of MEMS sensors by exploiting the complementary characteristics of different transduction mechanisms. In this talk, a silicon resonant accelerometer with capacitive and piezoresistive dual transductions is presented, in which the noise correlation between the two outputs can be tuned in real time. The device integrates a double-clamped beam resonator with capacitive electrodes and piezoresistive gauges, enabling simultaneous acquisition of two frequency signals from a single resonant structure. By adjusting the thermal bias applied to the piezoresistive gauges, the piezoresistive transduction gain is actively controlled, which in turn modulates the correlation between the two readout channels. A general second-order Kalman filter is then employed to fuse the demodulated frequency outputs with variable correlation. Experimental results show that the fused output achieves a resolution of 0.49 μg/ √ Hz, corresponding to an improvement of 10.45 dB over capacitive detection alone, while preserving the wide bandwidth of ~1150 Hz enabled by piezoresistive detection. This work demonstrates that tunable noise correlation provides an effective pathway for bandwidth-resolution co-optimization in resonant MEMS accelerometers.

Technical Sessions

D3-PM-B13: Award Finalist Session:CM Ho Best Paper Award in Micro/Nanofluidics

16:00-17:15, April 19, 2026 **Convention Hall D**

Session Chairs: Yi Zhang, UESTC; Yonggang Jiang, BUAA

16:00-16:15	**Paper ID:** Oral# 28 **Paper Title:** Evaluation of Soy Wax as a Material for Wax Printing on μPADs **Presenter:** Xinyi Chen, Shantou University
16:15-16:30	**Paper ID:** Oral# 62 **Paper Title:** A Nanofluidic Memristor Based on a Liquid-Liquid Interface **Presenter:** Xiaoxuan Yuan, Southeast University
16:30-16:45	**Paper ID:** Oral# 172 **Paper Title:** Magnetic Field- Induced Acceleration of Whole Blood in Capillaries **Presenter:** Zitong Ye, Shantou University
16:45-17:00	**Paper ID:** Oral# 377 **Paper Title:** Thermal Localization in Microfluidic Devices Using Auxiliary Heating/Cooling Channels **Presenter:** Faris Abdelrazeq, American University of Sharjah
17:00-17:15	**Paper ID:** Oral# 286 **Paper Title:** Characterization of Liquid Flow in Paper-Based Microfluidic Devices **Presenter:** Mohamed Abdelgawad, American University of Sharjah

Technical Sessions

D4-AM-A01: Micro Biosensing and Micro Manipulation

09:00-10:10, April 20, 2026 **Meeting Room 301A**

Session Chair: Haitao Zhao, Northwestern Polytechnical University

Keynote Speaker

09:00-09:30

Aaron Ho-Pui Ho

The Chinese University of Hong Kong

Bio: Professor Aaron Ho-Pui HO received his BEng and PhD in Electrical and Electronic Engineering from the University of Nottingham. Currently a professor at the Department of Biomedical Engineering, The Chinese University of Hong Kong (CUHK), his previous appointments include Associate Professor at the Department of Electronic Engineering, Associate Dean of Engineering, CUHK; Assistant Professor in Department of Physics and Materials Science, City University of Hong Kong; Senior Process Engineer for semiconductor laser fabrication in Hewlett-Packard. His service in the professional and academic community includes Chairman of Hong Kong Optical Engineering Society; Chairman of IEEE Electron Device/Solid-State Circuits (ED/SSC) Hong Kong Chapter, Admission Panel member of Technology Business Incubation Programme (IncuTech) operated by Hong Kong Science and Technology Parks Corporation (HKSTP); Council Member of The Technological and Higher Education Institute of Hong Kong (THEi). His current academic interests focus on nano-sized semiconductor materials for photonic and sensor applications, optical instrumentation, surface plasmon resonance biosensors, lab-on-a-chip, solid-state nanopore and biophotonics. He has published over 400 peer-reviewed articles, 33 Chinese and 6 US patents. He is a Fellow of SPIE.

Title: Single Molecule Analysis with a Pyramidal Silicon Nanopore

Abstract: We report herein a new solid-state nanopore device platform with which one can readily conduct rapid analysis of single molecules. The long-standing challenge of this topic is that currently such nanopores are based on the use of membrane proteins, which has a nanopore aperture of approximately 1 nm, is the sole option for practical nanopore devices. However, biological nanopores are extremely delicate, and they have limited chemical resistance and short operational lifetime. To address these issues, we have developed a new solid-state device platform featuring a pyramidal sub-nm oxidized nanopore (PSON). The device is fabricated via batch-mode processing relying solely on wet etching, thus enabling a drastic reduction in manufacturing costs. By utilizing the ultrathin oxide-coated silicon nanopore as an additional electrode, PSON further enables a 3-terminal sensing configuration.

Experimental results demonstrate exceptionally promising performance for single#molecule characterization and sequencing. The 3-terminal configuration provides a two-fold improvement in

signal-to-noise ratio relative to conventional ionic current blockade measurements. We have successfully sequenced ssDNA and peptide samples of various lengths in a single-read operation. Leveraging PSON's high chemical resistance, we have achieved real-time monitoring and sequencing of reaction products, specifically, the dissociation of a protein-DNA complex (via in situ pH modulation) and the enzymatic digestion of insulin to release its two constituent peptide chains. Furthermore, our PSON prototype exhibits no detectable performance degradation following a cumulative sequencing duration exceeding 150 hours.

Invited Speaker

09:30-09:50

Hou Han Wei

Nanyang Technological University

Bio: Dr. Han Wei Hou is an Associate Professor at the School of Mechanical and Aerospace Engineering (MAE), and Lee Kong Chian School of Medicine (LKCMedicine) at Nanyang Technological University Singapore (NTU). He is also an Adjunct Senior Research Scientist at Tan Tock Seng Hospital (TTSH), and currently serves as the Assistant Chair (Students) at MAE. Dr. Hou received his BEng (First Class Hons) and PhD degree in Biomedical Engineering at the National University of Singapore in 2008 and 2012, respectively. Upon graduation, he did his postdoctoral training at Massachusetts Institute of Technology (USA), and subsequently joined LKCMedicine as the inaugural LKCMedicine Postdoctoral Fellow in 2014. He started his research group at NTU (BioMicroSystems Laboratory, www.hwhoulab.com) in 2018 and his research interests include microfluidics blood diagnostics, organ-on-chips, and cell-based biomanufacturing. He has authored over 60 peer-reviewed journal publications and filed 15 patents/patent applications. His recent research awards and accolades include World's Top 2% Scientists (By Stanford University) (2023, 2024, 2025), International Academy of Medical and Biological Engineering (IAMBE) Early Career Award (2022), NTU College of Engineering Research – Young Faculty Special Mention (2022), and International Society for Advancement of Cytometry (ISAC) Innovators (2021).

Title: Label-Free Impedance Cytometry as In-line Process Analytical Tools in Cell Manufacturing

Abstract: Stem cell manufacturing using suspension cultures of microcarriers, hydrogel microparticles and 3D cell aggregates remain challenging due to due to uncontrolled biological variability and size heterogeneity. This highlights the need for novel process analytical tools (PAT) capable of single-particle and single-cell resolution. In this talk, I will share our recent advances in microfluidic impedance cytometry as a highly sensitive approach for high throughput label-free bioanalysis of single cells and stem cell aggregates. We will highlight our impedance-based PAT for monitoring cell differentiation and detection of low-abundance residual undifferentiated induced pluripotent stem cells (iPSCs), enabling robust assessment of stem cell product quality and safety in regenerative medicine. Besides analysis, we have also developed an impedance-based particle sorter for in-line bioreactor sampling and automated analysis of biomass, cell viability and stem cell differentiation. Importantly, its tunable, multi-parametric

sorting capabilities facilitate the fractionation of stem cell aggregates or microcarriers into user-defined size ranges and impedance signatures to improve cell product quality in continuous stem cell manufacturing.

Invited Speaker

09:50-10:10

Xiaoping Li

Tianjin University

Bio: Xiaoping Li, Ph.D., full-time research fellow at the State Key Laboratory of Precision Measurement Technology and Instruments, Tianjin University. His research interests include MEMS/microfluidics and instruments, DNA nanotechnology and biosensors. His researches have been published in journals such as Microsystems & Nanoengineering and Sensors and Actuators B: Chemical, as well as international conferences including IEEE MEMS, Transducers and IEEE NEMS. Dr. Li serves as a Young Editorial Board Member for the BioDesign Research journal. He received the Scifax. 6th Edition of Research and Recognition “Best Researcher Award”, and was nominated for the finalist of "CM Ho Best Paper Award in Micro/Nano Fluidics" in the IEEE NEMS 2022 conference.

Title: DNA-Based Molecular Pendulum Biosensor for Ultra-Sensitive Detection of Biomarkers

Abstract: Electrochemical sensing of biomarkers in complex biological matrices presents significant challenges in terms of selectivity and sensitivity. Here we introduce an advanced aptamer-integrated molecular pendulum sensing platform to address these limitations, with the powerful advantages of aptamers such as high affinity, ease of chemical modification, and adaptive conformational changes upon target binding. The aptamer was immobilized on the electrode surface via rigid double-stranded DNA pendulum, which was precisely and spatially controlled by using a DNA tetrahedron nanostructure as a scaffold. The field-induced regulation of the probes effectively overcomes the fundamental constraint of the Debye screening effect, thus enabling reliable detection in physiological ionic strength environments. This platform demonstrated exceptional performance for the quantitative detection of protein biomarkers, and demonstrated a versatile and generalizable strategy for wearable/implantable health monitoring devices for next-generation diagnostics and personalized medicine.

Technical Sessions

D4-AM-A02: Flexible Functional Materials and Devices

09:00-10:00, April 20, 2026 **Meeting Room 301B**

Session Chair: Taisong Pan, University of Electronic Science and Technology of China

Invited Speaker

09:00-09:20 **Ji-Hwan Ha**

Hanbat National University

Bio: - Assistant Professor, Department of Mechanical Engineering, Hanbat National University (March 2025 – present)
- Postdoctoral Researcher, Korea Institute of Machinery and Materials (September 2024 – February 2025)
- Ph.D. in Mechanical Engineering, Korea Advanced Institute of Science and Technology (KAIST) (August 2024)

Title: Advanced Functionalization Strategies for Electrospun Composite Nanfibers in Healthcare Applications

Abstract: Textiles, traditionally serving protective and decorative functions, evolve into smart materials with advanced biomedical capabilities, including antimicrobial, therapeutic, and diagnostic functionalities. In this study, we present a novel processing strategy to embed diverse functionalities into electrospun fibers, introducing new paradigms for wearable diagnostics and therapeutic textiles. Using electrospinning as the core fabrication technique, we developed a solution-phase blending approach to incorporate functional materials, an electrospun fiber nanostructure delivery system, and integration techniques for embedding these fibers into commercial textiles. These approaches enable the precise control of fiber morphology, chemical composition, and functional properties, facilitating the development of highly responsive, adaptable, and scalable wearable platforms. We further demonstrate a range of healthcare applications, including disease diagnosis[1], controlled drug release[2], and advanced drug de[3]. The integration of electrospun fibers into wearable sensor systems and therapeutic fabrics represents a significant advancement in personalized healthcare, paving the way for next-generation smart textiles that seamlessly blend medical functionality with daily wear.

Invited Speaker

09:20-09:40

Daniela Nunes Gomes

NOVA University of Lisbon

Bio: Daniela da Silva Nunes Gomes is an Assistant Professor at the Department of Materials Science of NOVA School of Science and Technology (NOVA FCT), Portugal, and a researcher at CENIMAT/i3N. She obtained her Ph.D. in Materials Engineering from Instituto Superior Técnico in 2012, with distinction, with a dissertation entitled Carbon dispersions in nanostructured metals. In 2013, she joined CENIMAT as a post-doctoral researcher, where she developed advanced functional materials for electronic applications under a project funded by Fundação para a Ciência e Tecnologia.

Since 2018, she has been lecturing several courses in the areas of Materials Engineering and Micro and Nanotechnology Engineering at NOVA FCT. She is also actively involved in the Nanofabrication and NANOVA laboratories at CENIMAT, where she serves as one of the lab managers and main operators of SEM and STEM facilities.

Her research activity is strongly focused on materials characterisation using electron microscopies, synthesis and structural characterisation of metal oxide-based nanostructures, and functional materials for electronic and photocatalytic applications. She has established extensive national and international collaborations and is the co-author of more than 100 peer-reviewed scientific publications, 2 books and 4 book chapters, with an h-index of 33 (Scopus).

Professor Nunes has participated in numerous competitive research projects, including European and national initiatives, acting as scientific/technical responsible and principal investigator. She is currently the principal investigator at CENIMAT of the PRR project Sustainable Stone by Portugal. Her multidisciplinary work bridges materials science, nanotechnology and advanced characterisation techniques, contributing to both fundamental research and applied technological development.

Title: Defect-Engineered TiO_2 Nanomaterials on Sustainable Substrates for Enhanced Solar Photocatalysis

Abstract: Sustainable photocatalytic nanomaterials have gained increasing attention for the removal of emerging contaminants from water, particularly pharmaceutical compounds. Titanium dioxide (TiO_2) remains one of the most widely studied photocatalysts due to its physicochemical stability, non-toxicity, and high photocatalytic efficiency; however, its practical implementation is hindered by limited visible-light absorption, rapid charge recombination, and challenges associated with recovery and reuse in powder form. Overcoming these limitations requires integrated and environmentally responsible material design strategies. This work introduces a green and scalable approach to address these limitations through structural modifications, defect engineering, and immobilization on sustainable substrates. Microwave-assisted synthesis is employed as a green, fast, cost-effective, and scalable route to control crystallinity, morphology, and defect formation, enabling the production of nanostructures with high surface area and enhanced reactivity. Calcium incorporation, including calcium derived from biowaste

sources [1], is explored as an effective approach to tune the TiO_2 structure by inducing structural defects, such as stacking faults, grain boundaries, and surface steps [2, 3]. The defect-rich TiO_2 nanomaterials were subsequently immobilized onto sustainable flexible substrates, including cellulose-based membranes, paper, and polymeric foams. These immobilization strategies address key challenges related to catalyst recovery, reusability, and large-scale applications. The combined effects of bulk and surface modifications significantly improve optical absorption, surface hydroxylation, active site density, and surface area, resulting in enhanced adsorption capacity and photocatalytic activity under solar irradiation. Reusability and ecotoxicity tests confirm the stability and environmental safety of the materials for long-term applications. This study presents a combination of structural modification achieved through a green synthesis route and sustainable immobilization to develop efficient, reusable, and eco-friendly TiO_2 photocatalytic platforms active under solar irradiation. The proposed approach aligns with circular economy principles and offers a scalable pathway for solar-driven water remediation.

Invited Speaker

09:40-10:00

Tianshuang Wang

Jilin University

Bio: Tianshuang Wang is an Associate Professor and Ph.D. supervisor at the College of Electronic Science and Engineering, Jilin University. His research focuses on MEMS gas sensors, flexible electronic devices, and intelligent sensing systems. He received his Ph.D. in Microelectronics and Solid-State Electronics from Jilin University in 2020, where he completed an integrated undergraduate–doctoral program under the supervision of Prof. Geyu Lu. He subsequently conducted postdoctoral research at the College of Chemistry, Jilin University, under the guidance of Academician Jihong Yu, supported by the National Postdoctoral Innovative Talent Program. He joined Jilin University as a faculty member in 2022.

To date, he has published 32 SCI-indexed papers as first author or co-corresponding author in leading journals, including Journal of the American Chemical Society, ACS Nano, Nano Letters, ACS Sensors, Small, and Sensors and Actuators B: Chemical. These publications have received 4,078 SCI citations, with an H-index of 37. The applicant also holds 7 granted Chinese invention patents. As Principal Investigator, he has led multiple research projects, including the National Natural Science Foundation of China (NSFC) Young Scientists Fund, a subproject of the National Key Research and Development Program, a subproject of the NSFC Regional Innovation and Development Joint Fund (Key Program), and the National Postdoctoral Innovative Talent Program. He also contributed to the organization of major international conferences, serving as Secretary-General of the 19th International Meeting on Chemical Sensors (IMCS) and the 9th GOSPEL Workshop.

Title: Wireless Wearable Gas Sensors Based on Conductive Metal-Organic Framework

Abstract: Flexible wearable gas sensors are rapidly emerging as a key technology for real-time health monitoring and environmental safety. However, three challenges persist: (i) conventional metal oxide

sensors require high operating temperatures, making them unsuitable for wearable applications; (ii) achieving high sensitivity and selectivity simultaneously at room temperature remains difficult; and (iii) bulky, battery-dependent designs compromise flexibility, comfort, and long-term reliability. In this talk, I will present a materials-to-system integrated strategy based on two-dimensional conjugated metal-organic frameworks (2D c-MOFs) to address these limitations. First, we establish a conductivity-sensing performance map in HHTP-based c-MOFs through the rational design of mono- and bimetallic systems (Cu, Co, Ni, Cu/Co, and Cu/Ni). We show that π – d conjugation coupled with interlayer π – π stacking plays a decisive role in governing charge transport and gas sensing behavior. Guided by this mechanism, the optimized Cu/Co-HHTP sensor exhibits high sensitivity, excellent selectivity, faster response/recovery dynamics, and minimal baseline drift at room temperature. Second, we develop a scalable, solvent-free fabrication strategy to produce centimeter-scale flexible thin films. These devices deliver high sensitivity, low detection limits, and exceptional mechanical durability, maintaining stable performance under repeated bending. Third, to overcome gas interference, we introduce a "sieving–sensing" bilayer architecture by integrating Pd/SSZ-13 zeolites with MOF films, enabling selective NH3 detection even in the presence of NO2 interference. Finally, by integrating NFC technology with LC resonant circuits, we realize a fully flexible, wireless, and battery-free sensing platform, capable of real-time monitoring in wearable conditions. Overall, this work establishes a general design framework for high-performance, room-temperature wearable gas sensors, bridging fundamental materials innovation with practical system integration for applications in smart healthcare and human–machine interfaces.

Technical Sessions

D4-AM-A03: Micro Biosensing and Micro Manipulation

09:00-10:30, April 20, 2026 **Meeting Room 301C**

Session Chair: Hong Zhou, Northwestern Polytechnical University

Keynote Speaker

09:00-09:30

Liqiu Wang

The Hong Kong Polytechnic University

Bio: Professor Wang Liqiu is the Otto Poon Charitable Foundation Endowed Professor in Smart and Sustainable Energy and Chair Professor of Thermal-Fluid Science and Energy Engineering in the Department of Mechanical Engineering at The Hong Kong Polytechnic University (PolyU). He also serves as the founding Director of the PolyU – Zibo Technology and Innovation Research Institute.

A leading figure in his field for over three decades, Professor Wang has pioneered systematic and groundbreaking research at the intersection of thermal-fluid science, energy engineering, and advanced manufacturing. His prolific scholarly record comprises more than 580 high-impact publications, 11 authored monographs, and over 40 patents, reflecting a sustained commitment to both fundamental discovery and technological innovation.

Professor Wang's global scholarly influence is demonstrated by his consistent recognition as a Clarivate Top 1% Highly Cited Researcher and his ranking among the World's Top 2% Most-Cited Scientists (Stanford University). His inventive work has garnered prestigious international accolades, including the OSA Innovation Award (2017), the Global Technology Innovation Award (2018), and multiple gold and silver medals at the Geneva International Exhibition of Inventions.

An active leader in the global academic community, Professor Wang serves on the editorial boards of over 30 international journals and has founded and chaired major international conference series. His expertise is widely sought by industry and government, underscoring his role in shaping the future of sustainable energy and fluidic systems. As an accomplished scholar and compelling speaker, he has delivered more than 100 invited and keynote lectures worldwide.

Title: Navigating the Invisible: Contactless Control of Liquids

Abstract: Precision liquid manipulation is the cornerstone of advancements in genomics, proteomics, clinical diagnostics, and drug discovery. Yet, the very properties of biological fluids—their divisibility, surface adhesion, and potential pathogenicity—pose formidable challenges, especially at minute volumes. Handling nano- and subnanoliter samples of infectious agents, such as Ebola virus in blood, presents

severe biohazard risks at every stage: from sample preparation and filtration to purification and disposal. Conventional methods, reliant on physical contact, perpetuate exposure dangers and generate contaminated plastic waste.

In this talk, Professor Wang unveils a transformative paradigm: contactless liquid manipulation using targeted external energy fields. By harnessing precisely applied sound, light, thermal, magnetic, or fiber-optic stimuli, this approach acts as a versatile "digital hand"—one that never gets wet. Professor Wang will demonstrate how this platform enables the on-demand navigation, fusion, division, and dynamic shaping of droplets entirely without surface contact.

This groundbreaking methodology promises to redefine safety protocols in biomedical laboratories and pharmaceutical production. By eliminating fluid-tool contact, it drastically reduces cross-contamination, mitigates infection risks for healthcare workers, and minimizes infectious waste. Furthermore, it paves the way for a significant reduction in single-use plastics, aligning cutting-edge science with urgent sustainability goals. Join us to explore how this contactless revolution can safeguard researchers, enhance reproducibility, and propel the life sciences into a safer, more efficient future.

Invited Speaker

09:30-09:50

Hong Zhou

Northwestern Polytechnical University

Bio: Professor Zhou received his Ph.D. in Engineering and is currently a Professor and Ph.D. Supervisor at Northwestern Polytechnical University, as well as a recipient of China's National Youth Talent Program. He serves as an Editorial Board Member of AI Sensors and Sensors International, a Youth Editorial Board Member of Nano-Micro Letters, and a Guest Editor for journals such as Nanomaterials. He has also been a regular reviewer for leading journals including Advanced Materials and Advanced Science. Professor Zhou's research focuses on infrared photonic chips and intelligent detection technologies. He has led a National Natural Science Foundation of China (NSFC) General Program, published over 60 papers, including more than 30 as first or corresponding author in high-impact journals such as Science Advances, Nature Communications, Chemical Society Reviews, and Advanced Materials. His work has been cited over 2,500 times on Google Scholar, with an h-index of 29. His research has been featured on the homepage of Science Advances, selected as a Cover Article and Editor's Choice in Advanced Materials, and included in the RSC "2023 Popular" Collection. He has received multiple academic honors, including Best Paper Awards at IEEE MEMS 2023 and Transducers 2025.

Title: Bridging Mechanics and Light: MEMS Photonic Sensors for the Next Generation of Smart Detection

Abstract: Microelectromechanical systems (MEMS) have emerged as a transformative platform for integrating mechanical reconfigurability, electrical tunability, and optical precision into a single chip-scale device. When combined with advanced photonic structures, MEMS technologies enable dynamic control over light–matter interactions, offering unprecedented opportunities for adaptive sensing, imaging, and inertial measurement. This talk presents recent progress in MEMS-based photonic biosensors,

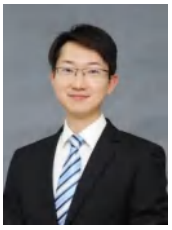
highlighting their potential to redefine the limits of sensitivity and multifunctionality across infrared and acousto-optic domains.

Invited Speaker

09:50-10:10

Shengtai Bian

Fujian Agriculture and Forestry University



Bio: Shengtai Bian received his Ph.D. degree from the Department of Biomedical Engineering, Center for Systems Biology and National Engineering Research Center for Beijing Biochip Technology at Tsinghua University. Currently he serves as a Professor and Doctoral Supervisor at the Research Center for Agricultural and Forestry Artificial Intelligence Sensors, Institute of Agricultural and Forestry Artificial Intelligence, Fujian Agriculture and Forestry University. He previously held the position of Director of the Microfluidic Equipment Innovation and R&D Laboratory at Beijing Sport University.

His research interests span the development of intelligent wearable devices and microfluidic rapid detection platforms with tailored applications in pathogen detection for agricultural production monitoring. He also devotes efforts to the rapid detection and analysis of cells and functional compounds as well as toxicological analysis biological signal pathway exploration and high-throughput screening technologies. His research work has been supported by multiple national-level programs including the 863 Program, 973 Program and National Natural Science Foundation of China. His findings have been published in a broad range of international mainstream journals such as VIEW, BMEMat, Lab on a Chip, Analytical Chemistry, SR, Sensors, Biomicrofluidics, Biosensors and Bioelectronics, Biological Trace Element Research, Chemistry – A European Journal and IEEE series journals. He additionally holds multiple authorized patents in microfluidic detection and biosensor technologies.

Title: Pathogen Detection Technologies for Agricultural Production Monitoring

Abstract: Reliable on-site detection of agricultural pathogens is critical for ensuring crop and aquatic product safety alongside smart production. This presentation reports a set of integrated sensing systems developed by the Research Center for Agricultural and Forestry Artificial Intelligence Sensors for agricultural pathogen monitoring.

Based on the center's "demand-driven, interdisciplinary integration" orientation, we built a trinity system covering core sensing technology, scenario-adapted equipment and industrialization. This system addresses gaps in agricultural on-site detection. We then detail key devices tailored for agricultural scenarios. A pathogen universal detection platform integrates microfluidic rapid detection and intelligent identification to enable on-site automated screening of known and emerging pathogens in crops and aquatic products. A high-sensitivity water quality detection system is optimized for common pathogens and features portability with real-time data output.

Performance validation and field application cases are introduced to demonstrate how these systems support practical agricultural production monitoring. This work illustrates the feasibility of intelligent sensing technologies in bridging lab research and agricultural production practice.

Technical Sessions

D4-AM-A04: Micro/Nanofabrication and Sensor

09:00-10:10, April 20, 2026 **Meeting Room 302A**

Session Chair: Lei Dong, Southeast University

Keynote Speaker

09:00-09:30 **Wen Wang**

Institute of Acoustics, Chinese Academy of Sciences/University of Chinese Academy of Sciences

Bio: Wang Wen, Ph.D., Professor at the Institute of Acoustics, Chinese Academy of Sciences/University of Chinese Academy of Sciences, Distinguished Researcher at the Chinese Academy of Sciences, Senior Member of IEEE, IAAM Fellow, Fellow and Executive Director of the Chinese Society of Acoustics, Vice Chairman of the Physical Acoustics/Micro Acoustics Branch, Director of the Chinese Society of Microscience and Nanotechnology, and Vice Chairman of the Acoustic Sensing and Instrumentation Special Committee of the Chinese Instrument and Meter Society. Published over 140 SCI papers; Chief editor of 2 monographs; Authorized over 40 invention patents; Won more than 10 international and domestic scientific and technological awards, including the Humboldt Research Achievement Award, IAAM Scientist Medal, WeiRongjue Award, China Electronic Element Association Technology Leading Figure Award, Beijing Science and Technology Progress Award, and Military Science and Technology Award; Previously selected as a national and Chinese Academy of Sciences innovation leader; Has won the Zhu Liyuehua Outstanding Teacher Award and the Outstanding Mentor Award from the Chinese Academy of Sciences.

Title: Micro-Nano Sensor Technology Based on Surface Acoustic Waves

Abstract: Surface acoustic wave (SAW) is a mechanical sound wave that propagates along the surface of a piezoelectric medium by depositing micro nano interdigital electrodes and exciting them using the piezoelectric effect. Due to the high frequency, excellent reciprocity and symmetry, and simple and flexible design of forked electrodes, as well as the use of semiconductor planar lithography preparation technology, SAW devices have become key analog components in fields such as mobile communication and radar, with an annual market application scale of over 10 billion. In addition, due to the concentration of sound energy on the surface of the medium, it is extremely sensitive to surface loads, forming another important development direction of SA

W technology, which is intelligent sensing. Compared to other sensing technologies, SAW sensors have technological advantages such as high sensitivity, speed, wide range, and high reliability, especially in providing a new type of passive sensing and wireless transmission, which has attracted widespread

attention and great interest. After nearly 30 years of development, a large number of surface acoustic wave sensors have been successfully applied to in-situ detection of multiple parameters such as temperature, mechanics, and gases in special fields such as national defense, power, intelligent manufacturing, and aerospace, demonstrating significant application value. This report will combine the research results of the laboratory team to report the research on the multi-parameter sensing effect, mechanism, device and system integration of SAW, as well as the application of sensors.

Invited Speaker

09:30-09:50

Hao Zheng

University of Electronic Science and Technology of China

Bio: Hao Zheng is currently an Associate Researcher at the School of Integrated Circuit Science and Engineering, University of Electronic Science and Technology of China. He holds senior membership in the Chinese Society of Micro-Nano Technology and membership in the Chinese Institute of Electronics. His research focuses on micro-electromechanical systems (MEMS), addressing MEMS integration challenges in biomimetic aerial vehicles operating under spatially constrained environments. He was selected for the Class A National Postdoctoral Innovation Program in 2024. Within this research domain, the applicant has published 14 SCI-indexed journal papers and 11 conference papers over the past five years. His research article was featured as a Featured Article with homepage highlights in Applied Physics Letters. His intellectual property portfolio includes 14 invention patent applications, with 4 patents granted. He has been recognized with awards including the Chinese Institute of Electronics Science and Technology Progress Award (Second Class) and the National Second Prize in the "Hongshan Open Source" Big Data Application Challenge. In terms of research leadership, he has led 3 provincial-level research projects and contributed as a key researcher to 7 national/provincial-level research projects.

Title: Flexible MEMS Integrated Wing Motion Perception for Bionic Microrobotics

Abstract: This work proposes a highly integrated electrostatic sensor-wing system and an intelligent motion sensing method for bio-inspired flying robots, realizing for the in-situ multi-target dynamic monitoring of flapping wing parameters (frequency, angle, and surface deformation) with ultra-low error. The locally adaptable electrostatic sensor-wing integration structure achieves miniaturization and lightweight design, and the established theoretical sensing model enables accurate mapping between electrostatic sensing signals and motion parameters. Experimental validation shows the flapping frequency monitoring error rate is less than 0.1%, and the wing pitch angle monitoring error affected by stability is less than 0.7°, providing a new solution for airborne wing state perception under weight constraints.

Invited Speaker

09:50-10:10

Yingning He

Xiangtan University

Bio: Yingning He received his PhD degree in Micro and Nano Systems from the University of Toulouse and LAAS-CNRS, France. He then conducted postdoctoral research at Fudan University, China, where he was awarded the title of Super Postdoctoral Fellow. In 2021, he joined Xiangtan University, where he established the Microfluidic Sensing Group. He is currently an Associate Professor and has been selected for the Hunan Provincial Hundred Talents Program and the Shaofeng Scholar of Xiangtan University. His research focuses on interdisciplinary studies based on MEMS and micro/nanofabrication, with particular interests in sensors, silicon- and polymer-based microfluidic chips, flexible and wearable electronics, brain – machine interfaces, and system-on-chip (SoC) edge systems for sensing applications.

Title: Micro/Nanofabricated Silicon and PDMS Microfluidic Platforms for Advanced Sensing Applications

Abstract: Micro/nanofabricated microfluidic platforms provide powerful routes to integrate sample handling, signal amplification, andon-chip sensing for both chemical and biological applications, This talk presents our recent progress in developing sllicon-based and PDMS-based microfluidic chips for advanced sensing applications, highlighting how material-specificmicro/nanofabrication enables distinct sensing functions. For the silicon platform, we focus on a lateral porous silicon (LPsi)microfluidic architecture that combines microfluidic confinement with nanostructured porosity.Owing to surface charge-governed ion transport and permselective effects, the LPsi junction supports electrokinetic preconcentration of targetanalytes via ion concentration polarization,enabling rapid enrichment from dilute samples for the improvement ofdownstream detection sensitivity. Meanwhile,the porous silicon structure provides an optically active interface, allowinglabel-free or enhanced optical sensing through modulation of refractive index and light-matter interactions within the porousnetwork.In parallel, we develop PDMS microfluidic platforms that emulate dynamic cellular microenvironments, Thesedevices enable mechanical stimulation and mechanotransduction at the cell level, where cyclic stretching or controlleddeformation is applied to investigate cellular responses under physiologically relevant mechanical cues, Furthermore, byintegrating microchannels, soft materials, and 3D culture strategies, the PDMS chips support brain-on-chip and neuro-inspired models, providing controllable microenvironments for long-term culture, functional interrogation, andmechanobiology studies, Collectively, these sllicon and PDMS microfluidic platforms demonstrate versatile capabilities forsample preconditioning, signal enhancement, and multimodal sensing.

Technical Sessions

D4-AM-A05: AI for Micro/Nano Electro-Mechanical Systems

09:00-10:00, April 20, 2026 **Meeting Room 302B**

Session Chair: Chen Wang, KU Leuven

Invited Speaker

09:00-09:20

Ye Yuan & Zuogong Yue

Huazhong University of Science and Technology

Bio: Ye Yuan, professor at the School of Artificial Intelligence and Automation, Huazhong University of Science and Technology. His research focuses on data-driven modeling and optimization theory and its industrial applications. He has served as the Principal Investigator for national-level projects, including the Key Program of the Major Research Plan of the National Natural Science Foundation of China (NSFC). He has published over 50 papers as the first or corresponding author in top international and domestic journals, such as National Science Review, Nature Machine Intelligence, Nature Communications, IEEE transactions, Automatica, etc., and over 30 papers in top international conferences, including COLT, CDC, IJCAI, and ICRA. He holds more than 20 granted invention patents, with successful technology transfer to sectors like the aviation industry. His accolades include the first prize of the 2022 Hubei Provincial Natural Science Award (rank 1) and a nomination for the 2020 IEEE Technical Committee on Cyber-Physical Systems Young Scientist Award.

Title: Data-driven Discovery of Continuous-time Dynamical Systems Under Sparse Sampling

Abstract: Data-driven discovery of governing equations has revolutionized the ability to model complex physical systems. However, a fundamental gap persists: while natural processes evolve continuously, our observations are often discrete, sparse, and captured at rates below those required by Nyquist-Shannon sampling theorem. In this talk, we address this challenge by integrating rigorous operator theory with a novel flow-consistent identification framework. We begin by introducing a sampling theorem for continuous-time nonlinear systems. By leveraging the Koopman operator, we establish a necessary and sufficient condition that defines a Nyquist-Shannon-like critical frequency for exact system identification. This theoretical boundary allows us to quantify and avoid system aliasing—a phenomenon where distinct continuous dynamics become indistinguishable from sampled data. Crucially, this criterion moves beyond the traditional band-limited signal constraints, offering a new perspective on the fundamental limits of learning from sparse measurements. Building on this theoretical foundation, we present Hybrid Analytic Neural Dynamics Identification (HANDI). Unlike conventional methods that rely on noisy numerical differentiation, HANDI operates in a function space capturing consistent flow map. By constructing a hybrid observable space that fuses interpretable analytic bases with orthogonal neural complements, the

framework achieves sampling-adaptive linearization. To ensure long-term predictive reliability, we incorporate recursive residual correction to mitigate error accumulation and maintain physical consistency. We demonstrate the power of HANDI across a range of canonical nonlinear systems and real-world datasets, establishing a robust pathway for reconstructing the continuous reality from its discrete, sparse fragments.

Keynote Speaker

09:20-09:50

Chengkuo Lee

National University of Singapore

Bio: Dr. Chengkuo Lee is Optica Fellow and director of the Center for Intelligent Sensors and MEMS at the National University of Singapore, Singapore. His Google Scholar citation is 50,000+. He is also recognized as one of the 21 most influential professors at NUS. Furthermore, he is Highly Cited Researcher Designation in 2023 and 2024 (Clarivate). He is the associate editor-in-chief of Trans. Nanotechnology (IEEE), editor-in-chief of AI Sensors (MDPI), and editor-in-chief of npj Self-powered Electronics (Nature). He is the Executive Editor of J Micromechanics and Microeng. (IOP, UK). He is the Associate Editor of J. MEMS (IEEE), Chip (Elsevier), and Internet of Things (Elsevier).

Title: AI Sensors and Edge AI Applications

Abstract: With the growing demand for energy-efficient AI applications, the rapid development of self-powered sensors together with edge computing and edge AI technology at the sensor nodes has led to the new era of AI sensors. Traditional sensors and sensing systems can no longer meet the demands for real-time multimodal sensing and large-scale data processing, leading to a shift towards a new paradigm of AI Sensors and Artificial Intelligence of Things (AIoT) sensing systems with integrated computational intelligence. Self-powered wearable sensors have promoted low-power or battery-free sensing platforms for applications including human-machine interaction, soft robotics, and electronic skin (e-Skin). By embedding triboelectric, piezoelectric, electromagnetic and hybrid nanogenerators directly into the sensing structure, the same transducer now harvests ambient mechanical, vibrational or thermal energy while generating electrical signals based on stimuli for sensing, creating genuinely self-sustained sensor nodes. Breathable tribo-ferroelectric textiles, hydrogel-based nano-generators and silk-derived e-skins exemplify this dual-function strategy, delivering gesture-tracking, pressure – temperature mapping and long-term physiological monitoring without external batteries. Furthermore, the emergence of "in-sensor computing and near-sensor computing" demonstrates the sensor nodes or edge applications with computational capabilities, reducing data transmission burdens while enhancing privacy and energy efficiency. Using optical edge computing platform advanced by Si Photonics sensors, optical edge AI sensors have become an attractive approach for enabling intelligent, energy-efficient, adaptive sensing networks.

Invited Speaker

09:50-10:10

Rui You

Beijing Information Science and Technology University

Bio: You Rui is a Professor and Doctoral Supervisor at the School of Instrument Science and Opto-Electronics Engineering, Beijing Information Science and Technology University. He is recognized as a national-level young talent, serves as the Deputy Director of the National Innovation Center for Micro and Nano Manufacturing, and is the Director of the Beijing International Science and Technology Cooperation Base. His research primarily focuses on micro/nano manufacturing and MEMS devices, with outstanding achievements in microsystem simulation and design, MEMS sensors/actuators, and intelligent integrated systems. These advancements have been applied in aerospace equipment, integrated circuits, health diagnostics, and environmental monitoring.

Over the past five years, he has published more than 50 high-level journal papers in publications such as Nature Communications, Advanced Materials, Advanced Functional Materials, Opto-Electronic Advances, Advanced Science, Research, and Microsystems & Nanoengineering. His work has been cited over 3,000 times, with an H-index of 24. He has been named among the World's Top 2% of Scientists.

Title: Intelligent Design Framework for MEMS Devices and Microsystems

Abstract: The proliferation of MEMS devices necessitates rapid and efficient design iterations to meet application-specific requirements. However, as device architectures grow increasingly sophisticated, the intricate, non-linear coupling between geometric parameters and electromechanical performance poses a significant bottleneck. Conventional design methodologies often lead to protracted development cycles and remain heavily reliant on expert intuition, thereby limiting thorough exploration of the vast design space. To address these challenges, advanced intelligent optimization algorithms are integrated into the design workflow, which facilitates expansive parameter-space exploration and automated design synthesis. By transcending the limitations of manual iteration, these intelligent approaches not only significantly enhance design efficiency but also enable the identification of global optima within complex multi-dimensional spaces.

Furthermore, recognizing that the ultimate performance of a MEMS device is governed by its integration with peripheral interface circuits and control systems, achieving a truly optimized microsystem requires a paradigm shift toward synergistic co-design, where structural and electronic parameters are optimized concurrently. The integration of intelligent algorithms with system-level co-simulation, as demonstrated in this work, facilitates the development of high-performance inertial sensors, providing a practical approach to achieve reliable microsystem performance under complex conditions.

Technical Sessions

D4-AM-A06: Non-linear Mechanisms Enabled M/NEMS

09:00-10:10, April 20, 2026 **Meeting Room 305**

Session Chair: Dong F. Wang, Jilin University

Keynote Speaker

09:00-09:30 **Jing Zhang**

Xi'an Jiaotong University

Bio: Jing Zhang is currently a Professor at School of Automation Science and Engineering, Xi ' an Jiaotong University. He obtained bachelor's and doctoral degrees from the Department of Mathematics and the Department of Automation at Tsinghua University in 2001 and 2006, respectively. He worked as a Postdoc at Tsinghua University from 2006 to 2008, and then worked at Department of Automation, Tsinghua University from 2008 to 2022. In 2022, he joined Xi ' an Jiaotong University and worked as a Second-Class Professor.

Professor Zhang mainly engaged in research on quantum and micro nano system control, optical microresonator sensors, etc. He has published more than 80 papers in authoritative journals in the fields of physics and control, e.g., IEEE Transactions on Automatic Control, Nature, Nature Photonics, Physics Reports, Physical Review Letters, Nature Communications. His work on chaotic propagation and stochastic resonance in optomechanical systems was selected as the cover hot paper of the June 2016 issue by Nature Photonics and was awarded as the "2016 Important Achievements in Chinese Optics". As the first author, his work has be awarded by the International Federation of Automatic Control (IFAC) as Young Author Award, which is one of the most important international awards in the field of Automation. He received support from the National Natural Science Foundation of China's Outstanding Youth Fund in 2016, and then selected as a Young Changjiang Scholar in 2017. In 2021, he was selected as a Changjiang Distinguished Professor.

Title: Optical Sensor Based on Chip-Integrated Optical Microresonator

Abstract: In recent years, with the development of cutting-edge technology, sensing techniques have approached the classical noise limit. Optical sensing technique based on optical microresonators, leveraging resonance enhancement and noise suppression technologies, holds the potential to break this limit while combining precision and size advantages. Additionally, optical microresonator sensors can achieve on-chip integration through semiconductor silicon-based fabrication techniques. The report introduces the development and applications of chip-integrated optical microresonator sensors.

1) First, we introduce the fundamental principles, competitive advantages, and our progresses of optical

microresonator sensors.

2) Next, we elaborate on three application scenarios of optical microresonator sensors in underwater target detection and autonomous navigation: i) The application of optical microresonator sensors in autonomous navigation, specifically for gyroscopes and accelerometers; ii) The application of optical microcavity sensors in underwater acoustic detection, namely hydrophones. We detail their detection principles, results from pool calibration, lake trials, and sea tests, with calibration results surpassing traditional piezoelectric hydrophones by 1-2 orders of magnitude; iii) The application of optical microresonator sensors in underwater target magnetic detection, with a detection accuracy of 0.19pT/Hz^1/2, and verification experiments using simulated radar scanning are provided.

3) A prospect was made for the application of optical microresonator sensors in quantum sensing.

Invited Speaker

09:30-09:50

Bo Zhang

Southwest Jiaotong University

Bio: Bo ZHANG is currently an associate professor in the School of Mechanics and Aerospace Engineering at Southwest Jiaotong University. His main research areas include vibration, buckling, and rigid-flexible coupling dynamics of micro/nano-scale structures, as well as computational mechanics theories at the micro/nano scale. Since 2011, he has been dedicated to cross-scale mechanics of micro/nano structures, focusing on theoretical modeling and numerical method innovation within the framework of couple stress/strain gradient theory. He has also participated in experimental studies on scale effects, such as torsion of micron-scale metal wires and bending of micro-cantilevers. To date, he has published over 80 academic papers. Representative works have appeared in leading international journals including Phys. Rev. Lett., Acta Mater., J. Mech. Phys. Solids, Int. J. Eng. Sci., Int. J. Plast., Int. J. Mech. Sci., Int. J. Solids Struct., Compos. Struct., Compos. Part B Eng., Thin-Walled Struct., and Aerosp. Sci. Technol., with a total citation count exceeding 2,700.

Title: Experimental Investigation and Theoretical Modelling on Nonlinear Dynamics of Cantilevered Microbeams

Abstract: The nonlinear vibration of cantilever nickel microbeams with thickness in micron level is investigated through experiment and theory. A non-contact dynamic vibration measurement system is built to test the fundamental linear frequency and the nonlinear amplitude-frequency curves near the primary resonance. Experimental result reveals the nonlinear amplitude-frequency curves exhibit a marked weak softening-type behavior as well as hysteresis behavior. To elucidate the experimental observations, a modified couple stress-based Euler-Bernoulli beam model incorporating geometric and inertial nonlinearities is established. The derived partial differential equation of motion is converted into a set of ordinary differential equations (ODEs) by employing the Galerkin method. And then, the multi-dimensional Lindstedt-Poincaré (L-P) method is applied to solve these ODEs. By comparing these analytical and experimental results, a good agreement is observed. Besides, a p-version Ritz method is combined with the iteration algorithm to reveal the close similarity of the beam and plate models and to

further demonstrate the size-dependency in the nonlinear regime. Meanwhile the size-dependency in nonlinear regime is demonstrated. The effects of different order nonlinear terms, length scale parameter and damping coefficients on the system are investigated. It is illustrated that the period-doubling bifurcation occurs when imposing sufficiently large excitations, and it turns into chaos with increasing the excitations continuously.

Invited Speaker

09:50-10:10

Ming Lyu

Inner Mongolia University

Bio: Ming Lyu received a B.S. Degree in vehicle engineering in 2014 from Guizhou University, Guizhou, China. The M. S degrees in automobile engineering in 2018 from Northeastern University, Shenyang, China. In 2022, he graduated from Dalian University of Technology with a Ph.D in Automotive Engineering. He is now a lecturer at the Transportation Institute at Inner Mongolia University, his research interests include modal localization, nonlinear dynamics and sensor design.

Title: Design and Modeling of a MEMS Accelerometer Based on Coupled Nonlinear Resonators Under Electrostatic Actuation

Abstract: Microelectromechanical system (MEMS) accelerometers, with advantages of miniaturization, intelligence, low power consumption, and scalable fabrication, are indispensable in aerospace, inertial navigation, biomedical, and consumer electronics. In this paper, a novel mode localization accelerometer with electrostatic coupled resonators is proposed, two proof mass are connected to their respective resonators via lever amplification mechanisms, with the two resonators coupled electrostatic. By combining a symmetric lever – resonator topology with electrostatic modulation, the device converts inertial loading into stiffness perturbations, inducing energy redistribution and amplitude localization. We demonstrate that by adjusting the drive voltage, the coupled resonator exhibits both linear and nonlinear behavior. And then to investigated the sensitivity under different vibration conditions, and experimental results show that sensitivity decreases during nonlinear vibration.

Technical Sessions

D4-AM-A07: Flexible Biosensors

09:00-10:40, April 20, 2026 **Meeting Room 306**

Session Chair: Guang Yao, University of Electronic Science and Technology of China

Invited Speaker

09:00-09:20 **Wei Lan**

Lanzhou University

Bio: Lan Wei, professor and doctoral supervisor, School of Physical Science and Technology, Lanzhou University. Longyuan talent, selected as the top 2% of the world's top scientists beginning from 2023, Huawei spark Award winner 2024. In 2007, he graduated from the School of Physical Science and Technology of Lanzhou University, majoring in condensed matter Physics. In 2010, he worked as A postdoctoral fellow in the research group of Prof. John A. Rogers at the University of Illinois at Urbana-Champaign, USA, and presided over more than 20 national and provincial and ministerial projects. His interest is the applied basic research in the field of flexible electronics, and he has been published more than 100 papers in Sci. Adv., PNAS, Adv. Mater., Adv. Funct. Mater.. H-index is 36. 26 national patents have been declared, 10 of which have been authorized. He edited a textbook of Electronic Materials and Device Experiments and participated in the compilation of an English monograph.

Title: Flexible Electronics for Healthcare Applications

Abstract: This report will present the major advances achieved by the flexible electronics research team at Lanzhou University, including flexible transparent hyperthermia patches, biodegradable supercapacitors, and wireless postoperative treatment systems. In particular, this talk will introduce our recent work on a wireless, bioresorbable postoperative treatment system for tumor management. Postoperative tumor recurrence remains a major challenge following surgical resection, and the development of implantable platforms capable of integrating multiple therapeutic functions has attracted considerable interest. Here, we developed a multifunctional bioresorbable system that integrates temperature feedback, photothermal therapy, and demand drug release into a single platform. The device enables localized postoperative intervention and is designed to degrade after completing its therapeutic function.

Invited Speaker

09:20-09:40

Guang Yao

University of Electronic Science and Technology of China

Bio: Dr Yao has spearheaded pioneering research in flexible diagnostic and therapeutic electronic devices, focusing on critical scientific challenges such as in-situ multimodal sensing diagnosis, physical field intervention therapy, and their correlation models. His research has yielded 70 articles published in SCI journals, with 20 first- or corresponding-authored papers appearing in prestigious international journals such as Nat. Commun., PNAS、Sci. Adv., and Sci. Bull. These publications have garnered over 3000 citations. Additionally, he has secured 21 Chinese patents and 1 US patent and has delivered 6 oral presentations at international academic conferences. Furthermore, the applicant has collaborated with industry partners and hospitals to conduct trials of devices, thereby accelerating their industrial applications.

Title: Flexible Diagnostic and Therapeutic Electronic Devices

Abstract: Bioelectronic devices play a crucial role in establishing a Human-Machine Interface (HMI) for real-time monitoring of human physiological signals, offering timely interventions in disease management, a fundamental requirement for comprehensive health management spanning from diagnosis to therapy. To meet portability and suitability, the HMI field has witnessed significant progress in developing flexible bioelectronic devices driven by advancements in modern technologies. Flexible bioelectronics subverts the physical form and breaks through the bottleneck of traditional rigid electronics, which maintains high performance and reliability and introduces the transformative features of bendability and stretchability. Developing diagnostic and therapeutic electronic devices forms the cornerstone of intelligent healthcare systems. Stretchable, flexible diagnostic and therapeutic electronic devices can adapt to the human body, enabling precise physiological signal sensing and targeted stimulation interventions. These devices are crucial for early diagnosis and treatment of major diseases, enhancing health protection and the efficiency of medical resource utilization. Developing integrated and multifunctional flexible devices, with sensors at their core, is essential to meet the diverse needs of applications like intelligent health management systems. Our work focuses on the core issue of "elastic strain regulation function integration" in these devices, focusing on three key areas: co-sensing of complex functional interfaces under significant deformation, collaborative intervention through multi-field sensing and transducers, and feedback mechanisms in flexible systems. It also covers advances in physical and chemical sensing, damage repair, neural regulation, and human-computer interaction. The progress in sensing, diagnosis, and interventional treatment technologies has synergistically expanded the application of devices into integrated diagnosis and treatment. This evolution is poised to introduce a new era of electronic devices dedicated to precision medicine and health management.

Invited Speaker

09:40-10:00

Yadong Xu

Peking University

Bio: Dr. Yadong Xu is an assistant professor at Peking University. He was a postdoctoral researcher in Medical Engineering Department at California Institute of Technology before joining PKU. He received B.S. degree in Materials Chemistry from Sichuan University, M.Res. degree in Drug Sciences from University College London, and Ph.D. degree in Chemical Engineering from University of Missouri Columbia. His research focuses on pioneering next-generation bio-integrated electronics to address unmet clinical needs in precision and personalized healthcare. His work establishes a synergistic pipeline that spans from the fundamental design of soft biomaterials and scalable manufacturing to the development of self-powered, multimodal wearable and implantable devices, enhanced by artificial intelligence for advanced data analysis and diagnostics.

He is a recipient of the Science Fund Program for Distinguished Young Scholars of the National Natural Science Foundation of China (Overseas). He is an Editorial Board Member of Discover Electronics (Springer Nature). He received Chinese Government Award for Outstanding Self-financed Students Abroad, Outstanding Chemical Engineering PhD Student Award, Raymond White Dissertation Year Fellowship, and has published more than 20 research articles, including first-authored research works at world-known high-profile journal Nature Nanotechnology, Science Advances, Proceedings of National Academy of Sciences of the United States of America, and a book chapter published by Elsevier, with over 1,800 citations and h-index of 16. His research works were highlighted by Nature, Nature Nanotechnology, Matter, and have been extensively disseminated across a number of media outlets.

Title: Strain-Resilient Bioelectronics for Personalized and Precision Healthcare

Abstract: Strain-resilient bioelectronics are emerging as a foundational platform for personalized and precision healthcare. By conformally integrating with soft, dynamically deforming tissues, these systems enable long-term, continuous monitoring of physiological status. In contrast to conventional stretchable devices, whose electrical and electrochemical readouts often drift under bending, stretching, and torsion, strain-resilient architectures are strategically engineered to maintain signal fidelity under physiologically relevant strains and motions. In this talk, I will present our materials and device-level strategies for creating mechanically adaptive yet electrically and chemically stable biointerfaces, including intrinsically stretchable breathable substrates, highly conductive strain-resilient interconnects, and electrochemical interfaces that decouple mechanical deformation from electrophysiological recording and electrochemical sensing. I will then highlight wearable and implantable platforms for multimodal measurement of electrophysiological signals and molecular biomarkers, including sweat and tissue metabolites related to cardiometabolic fitness, early disease screening, and longitudinal health management.

Invited Speaker

10:00-10:20

Zhihua Pu

Tianjin University

Bio: Dr. Zhihua Pu is an Associate Professor at Tianjin University, China. His research focuses on epidermal diagnostic & therapeutic technologies and devices. He has developed a variety of wearable sensors and devices, including wearable epidermal sensors, wearable blood glucose meters, and wearable transdermal drug delivery patches. As the first or corresponding author, he has published 24 papers in high-impact journals such as Nature Communications, Science Advances, and Biosensors & Bioelectronics, along with 19 papers in top international academic conferences including IEEE MEMS, Transducers and IEEE Sensors. He holds 24 authorized Chinese invention patents and has contributed to three book publications. Dr. Pu was honored with the National Outstanding Doctoral Dissertation Award in the field of Measurement Control and Instrumentation and has been selected as a Tianjin Young Science and Technology Talent. He has also served as a Session Chair at the IEEE Sensors 2024 conference, and as a Guest Editor for the journal Micromachines. In addition, he acts as a reviewer for top journals such as Nature Communications, Biosensors & Bioelectronics, and Microsystems & Nanoengineering.

Title: Non-Invasive Continuous Glucose Monitoring Based on Reverse Iontophoresis

Abstract: Glucose monitoring is a foundation for diabetes diagnosis and treatment. Currently, the widely used fingertip blood glucose meters rely on invasive measurements, which cause noticeable pain, result in poor patient compliance, and may miss critical glycemic events due to limited sampling frequency. Therefore, dynamic and continuous glucose monitoring is of great importance. Most mainstream continuous glucose monitoring systems on the market implant microsensors subcutaneously to measure glucose levels in interstitial fluid — still an invasive or minimally invasive approach. More importantly, implanted sensors are susceptible to complex physiological environments, leading to a gradual decline in accuracy over time. Extracting interstitial fluid for external measurement may offer a better alternative. Advances in flexible electronics have spurred growing interest in wearable glucose monitoring. Reverse iontophoresis, being non-invasive and amenable to device miniaturization, holds particular promise for wearable devices. However, high-current-density extraction can cause skin irritation, and the accuracy of measurements is easily compromised by factors such as natural sweating. These limitations restrict its clinical applications. Our team has developed a non-invasive continuous glucose monitoring technology that addresses the issues of skin irritation and measurement inaccuracy. We introduced three key strategies: thermal activation to enhance permeability, nanostructure modification to improve sensitivity, and ionic calibration to compensate for individual variability and sweat interference. Based on these innovations, we developed a self-calibrated wearable sensor capable of high-precision dynamic and continuous blood glucose monitoring. This work provides a new direction for the development of non-invasive continuous glucose monitoring devices.

Invited Speaker

10:20-10:40

Ya Huang

Fudan University

Bio: Ya Huang is currently an Associate Professor at Fudan University. She received her B.S. (2015) and Ph.D. (2020) degrees from the School of Materials Science and Engineering, Tsinghua University, and earned a master degree (2018) in Organic and Polymeric Materials from Tokyo Institute of Technology. From 2020 to 2024, she conducted research at City University of Hong Kong on flexible haptic feedback devices and flexible bioelectronic devices. In 2025, she joined the Institute of Fiber Materials and Devices at Fudan University. Her research interests include flexible material synthesis, micro-/nano-device design, and system integration, focusing on novel wearable electronic devices and exploring their applications in information feedback, intelligent human–machine interaction, and healthcare. Prof. Huang has published more than 50 peer-reviewed papers papers, including Nature, Nature Electronics, Nature Reviews Materials, Science Advances, etc. She was awarded National High-Level Young Talent Program of China and the Shanghai Magnolia Talent award.

Title: Wearable Closed-Loop Multimodal Sensory Modulation System

Abstract: Wearable devices have substantial potential in smart terminals and healthcare, where closed-loop sensory sensing and feedback are essential for intelligent interaction (e.g., closed-loop haptic sensing and feedback). This report investigates flexible closed-loop sensory modulation devices and integrated systems, spanning flexible material synthesis, tactile actuator design, and closed-loop system integration. We developed tissue-compatible flexible electrode materials that enable activation and modulation of tactile nerves across diverse skin regions and subcutaneous tissues. By leveraging multimodal feedback and integrating electrical stimulation, mechanical force feedback, and thermal regulation, we developed flexible tactile interfaces capable of reproducing realistic, material-specific touch sensations. Furthermore, we developed a wireless control circuit based on an ultrathin, stretchable metal architecture, enabling high-performance closed-loop tactile operation and providing a scalable pathway toward next-generation intelligent wearables.

Technical Sessions

D4-AM-A08: Biomimetic Microelectromechanical Systems (MEMS) Technology

09:00-10:10, April 20, 2026 **Meeting Room 307**

Session Chair: Yonggang Jiang, Beihang University

Keynote Speaker

09:00-09:30

Zhiwu Han

Jilin University

Bio: Zhiwu Han, professor and doctoral supervisor, is currently the director of Key Laboratory of Bionic Engineering (Ministry of Education) of Jilin University. His research encompasses the study in mechanical bionics, bionic perception theory and technology, bionic functional surface and advanced biomimetic composites. His work aims to apply mechanical bionic principles to hypersensitive sensors, lightweight high-strength materials, and micro-nano manufacturing. He serves as a fellow of the International Society of Bionic Engineering, the associate editor of Journal of Bionics Engineering, and vice chairman of the editorial board of Chinese Journal of Mechanical Engineering. To date, Prof. Han has authored more than 100 peer-reviewed papers in notable journals, including Nature, Science Advances, Advanced Materials, Progress in Materials Science, and Materials Today. His pioneering work in mechanical bionics has won more than 5 significant awards at the national or provincial level, such as Second Prize of the State Technological Innovation Award, First Prize of the Ministry of Education Technology Invention Award, First Prize of the Jilin Province Technology Invention Award, First Prize of the Mechanical Industry Science and Technology Award, etc.

Title: Bionic High-Performance Perception Theory and Technology

Abstract: Sensors, which serve as crucial instruments for gathering external information, have drawn substantial attention in domains such as electronic skin, human-computer interaction, and precision instrumentation. Among these, mechanical sensors represent a major area of research focus. However, the performance of existing mechanical sensors in terms of weak vibration detection, target signal identification, and vibration source localization is difficult to meet the practical requirements. Therefore, it is important to find innovative methods to design high-performance mechanical sensors. Over billions of years of evolution, the fusion of organisms and nature has become perfect. This report takes the scorpion as its biological prototype. Through systematic bionic studies, a range of intrinsic mechanisms underlying the scorpion's remarkable perceptual functions have been revealed. These principles enable scorpions to detect faint stimuli, accurately discriminate signals, and quickly locate vibration sources even in complex settings, which is conducive to avoiding enemies and hunting for food in harsh conditions to maintain survival. Drawing inspiration from such ingenious biological strategies, corresponding designs and

fabrication methods for biomimetic sensors have been developed and widely applied in fields such as automotive industry manufacturing, micro-vibration monitoring of bridges, and fault monitoring of precision equipment.

Invited Speaker

09:30-09:50

Yanling Liu

Wuhan University

Bio: Yan-Ling Liu received her B.S. in Chemistry from Zhengzhou University in 2011 and Ph.D. in Analytical Chemistry from Wuhan University in 2016. Currently, she is a professor at Wuhan University. Her research interests focus on the stretchable electrochemical sensing for real-time monitoring of cell mechanotransduction.

Title: Nanomesh Electrodes for Basement Membrane Mimicking and Cell Monitoring

Abstract: Cells in vivo are soft and can perceive and respond to mechanical changes in the surrounding environment by converting external mechanical stimuli into internal biochemical signals, which regulates cell proliferation, differentiation and fate determination. However, rigid electrodes (such as metallic or silicon-based materials) have a Young's modulus on the order of GPa, and their mechanical mismatch with soft cells may lead to aberrant signal transduction pathways and even distorted monitoring data. Therefore, flexible electrodes with biomimetic mechanical properties are urgently needed for precise and long-term monitoring of cell functions. To this end, we fabricated soft electrodes based on conductive polymer nanomesh with a Young's modulus of several MPa, comparable to those of extracellular matrix proteins-derived fibers. They allowed real-time monitoring of signaling molecules (e.g., H2O2 and NO), electrophysiological activity and contraction force of beating cardiomyocytes. Furthermore, magnetic nanoparticles encapsulated within nanofibers were designed to fabricate a magnetically responsive flexible electrochemical sensor, which holds great potential for remote mechanical stimulation and real-time monitoring of various biological systems, ranging from living cells to soft tissues and in vivo organs.

Invited Speaker

09:50-10:10

Xuge Fan

Beijing Institute of Technology

Bio: Xuge Fan is a professor and PhD supervisor at Beijing Institute of Technology (BIT) and is recipient of the National Natural Science Foundation of China's Excellent Youth Fund (Overseas). He obtained his PhD degree at the Royal Institute of Technology. He heads the research team of MEMS and NEMS and graphene Based 2D Materials in BIT with main research topics on MEMS/NEMS, micro-nano sensors, graphene, TMDCs and related 2D materials. He has pioneered the development of ultra-small, high-sensitivity graphene nanoelectromechanical accelerometer prototype devices.

Prof. Fan has published over 50 papers in high-quality journals and conferences such as Nature Electronics, Science Advances, Nano Letters, ACS Nano, CEJ, and Microsystems &

Nanoengineering, and has been granted and applied for 16 Chinese invention patents. He has given nearly 20 invited presentations at academic conferences both domestically and internationally. He leads multiple projects and has long served as a reviewer for dozens of journals such as Nature Communications, ACS Nano.

Title: Flexible Wearable Sensors Based on Low Dimensional Materials

Abstract: Low dimensional materials are promising materials for flexible wearable sensors due to their large specific surface area and excellent physical and chemical properties. This report will first show the flexible wearable humidity sensors for human respiration monitoring, motion monitoring, and nontouch switches, which are based on the low dimensional composite films such as rGO/MoS2, GO/MoS2, GO/WS2, GOQDs/WS2 and bacterial cellulose/MXene/GO. Secondly, it shows a sensitive flexible pressure sensor based on MXene/GOQDs/MS aerogel for machine learning powered human sitting posture recognition. Last, a fully printed all-resistive dual-mode sensor by using multi-walled carbon nanotubes as conductive fillers and GO and ethyl cellulose as binders will be introduced, which had ultra-low temperature coefffcient of resistance for crosstalk-free detections of pressure and humidity. The humidity-pressure dual mode sensors were applied for non-contact measurement and intelligent chair for sedentary monitoring.

Technical Sessions

D4-AM-A09: Surface/Interface Functional Electronics

09:00-10:10, April 20, 2026 **Meeting Room 308**

Session Chair: Wei Tang, Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences

Keynote Speaker

09:00-09:30 **Zhou Li**

Tsinghua University

Bio: Professor at the School of Biomedical Engineering, Tsinghua University; Director of the Health Technology Innovation Center, Clinical School of Medicine, Tsinghua University / Beijing Tsinghua Changgung Hospital; and Council Member of the Chinese Society of Biomedical Engineering. His research focuses on the innovation and engineering translation of novel bioelectronic devices and medical devices. He was the first in the world to propose self-powered bioelectronic devices and has applied them in the translation of cardiac pacemakers, earning the Second Prize for Science and Technology from the Beijing Municipal Government. He has been honored as a Distinguished Young Scholar funded by the National Natural Science Foundation of China, a Distinguished Young Scholar funded by the Beijing Natural Science Foundation, a recipient of the National Ten-Thousand Talents Program, a recipient of the Program for New Century Excellent Talents in University from the Ministry of Education, and has been named to Clarivate's Highly Cited Researchers list and the World's Top 2% Scientists list.

Title: Research Progress of Self-Powered Cardiac Pacemakers

Abstract: Electrical activity is fundamental to human life activities. Regulating this electrical activity can alter the excitation and inhibition of cells, tissues, and organs, thereby enabling the treatment of diseases. Triboelectric nanogenerators, a novel type of energy conversion device that converts low-frequency mechanical energy into electrical energy, offer new approaches for the development of self-powered medical devices due to their advantages such as structural diversity, flexibility, weavability, wide material selection, and high output voltage. Using this technology, we have developed several innovative systems: a cardiac pacemaker that harvests energy from heartbeats to drive its long-term operation, creating a pacemaker that can coexist symbiotically with the human body, and for the first time, we have successfully demonstrated heart rate elevation and arrhythmia treatment in large animal studies; we have developed degradable self-powered electrical stimulation devices capable of regulating the growth direction of nerve cells, enhancing electrical integration among myocardial cells, promoting osteoblast proliferation and differentiation, and accelerating skin wound healing, with the devices being completely absorbed by the body after treatment; we have also developed a closed-loop low-level vagus nerve stimulation system that achieves therapeutic effects while reducing the risk of complications associated with nerve

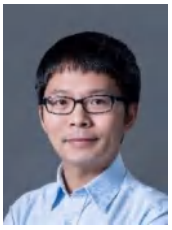
stimulation. These research efforts, focused on self-powered electronic medical devices and electrical stimulation therapies, hold significant potential for translation into clinical electronic medical devices and medical sensors.

Invited Speaker

09:30-09:50

Xuemin Du

Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences.



Bio: Xuemin Du is a full professor at Shenzhen Institute of Advanced Technology (SIAT), Chinese Academy of Sciences (CAS), where he is also the Director of Center for Intelligent Biomedical Materials and Devices (IBMD). His research interests cover mainly intelligent polymers, bio-adaptive interfaces, and smart wearable and implantable devices (e.g., soft sensors & actuators, tissue engineering scaffolds, bioelectronics). He has published high impact articles in Science Advances, Matter, Advanced Materials, Device, etc. He was awarded the National Science Foundation of China's Excellent Young Scientists in 2020, the RSC Nanoscale Emerging Investigator in 2021, and 2023 Nano Research Young Innovators (NR45) Awards. Currently, he is the deputy Editor of Research and Advanced Bionics, and also serves on the editorial boards of numerous esteemed international journals, including The Innovation, National Science Open, and BMEMat.

Title: Neuron-Inspired Ferroelectric Bioelectronics

Abstract: Implantable bioelectronics, which are essential to neuroscience studies, neurological disorder treatment, and brain-machine interfaces, have become indispensable communication bridges between biological systems and the external world through sensing, monitoring, or manipulating bioelectrical signals. However, conventional implantable bioelectronic devices face key challenges in adaptive interfacing with neural tissues due to their lack of neuron-preferred properties and neuron-similar behaviors. Here, we report innovative neuron-inspired ferroelectric bioelectronics (FerroE) that consists of biocompatible polydopamine-modified barium titanate nanoparticles, ferroelectric poly(vinylidene fluoride-co-trifluoroethylene) copolymer, and cellular-scale micropyramid array structures, imparting adaptive interfacing with neural systems. These FerroE not only achieve neuron-preferred flexible and topographical properties, but also offer neuron-similar behaviors including highly efficient and stable light-induced polarization change, superior capability of producing electric signals, and seamless integration & adaptive communication with neurons. Moreover, the FerroE allows for adaptive interfacing with both peripheral and central neural networks of mice, enabling regulation of their heart rate and motion behavior in a wireless, non-genetic, and non-contact manner. Notably, the FerroE demonstrates unprecedented structural & functional stability and negligible immune response even after 3 months of implantation in vivo. We can envision that such bioinspired FerroE would open new opportunities for next-generation brain-machine interfaces, tissue engineering materials, and biomedical devices.

Invited Speaker

09:50-10:10

Jun Yin

Nanjing University of Aeronautics and Astronautics

Bio: Prof. Yin obtained his Ph.D. degree from Nanjing University of Aeronautics and Astronautics (NUAA) in 2016, following which he worked in the University of Manchester as a research associate for three years. Then, he joined in NUAA in 2019 as a full professor. His work has focused on the interface interaction for novel mechanical, energy and information devices. He has published over 100 papers with more than 10 Nature series, with total citations over 9,000 and an h-index of 40 (Google Scholar).

Title: Ion – Electron Hybrid Artificial Neuron

Abstract: Artificial neurons are central building blocks for neuromorphic systems, but most existing solid-state implementations suffer from limited frequency tunability and require separate sensing modules, restricting their ability to emulate the diversity and efficiency of biological neural systems. In this work, we report an ion – electron hybrid artificial neuron that couples a redox-based electrochemical element with a threshold memristor. Owing to the nonlinear ion-transfer kinetics and dynamically evolving interfacial impedance, the neuron exhibits spiking frequency modulation over five orders of magnitude under a small voltage variation, while maintaining key neuron-like characteristics such as action potentials and refractory behavior. Moreover, the ion-electrochemical interface inherently responds to environmental stimuli, enabling direct encoding of flow, temperature, and chemical signals into spike frequency without external sensors. Applications in bio-hybrid actuation and handwritten pattern recognition demonstrate a compact sensing-computing platform for advanced neuromorphic electronics and neurointerface technologies.

Technical Sessions

D4-AM-A10: 3D Printing and Bioprinting

09:00-10:20, April 20, 2026 **Convention Hall A**

Session Chair: Maobin Xie, Guangzhou Medical University

Invited Speaker

09:00-09:20

Guosheng Tang

Guangzhou Medical University

Bio: Guosheng Tang is a professor and doctoral supervisor at Guangzhou Medical University. His research primarily focuses on the preparation of microgels using 3D bioprinting and novel microfluidic technology for cell delivery, regenerative medicine, and other related fields. In 2021, he was appointed as a full-time "Nanshan Distinguished Professor" at Guangzhou Medical University under the Guangdong Provincial High-Level University Development Program. He also serves as a committee member of the Bio-Manufacturing Engineering Branch of the Chinese Mechanical Engineering Society, a member of the Vascular Branch of the Chinese Society for Anatomy, and a committee member of the 3D Bioprinting and Tissue Regeneration Branch of the Guangdong Society of Biomedical Engineering. Additionally, he is a young editorial board member for journals such as Nano-Micro Letters and Exploration. He has published over 20 SCI papers as the first or corresponding author in journals such as Nature Microbiology, PNAS, Nature Communications (three times), and Advanced Materials (twice), among others. His publications have received more than 4,000 citations, an h-index of 30, a cumulative impact factor exceeding 600, and an average impact factor of 15 or more. Five of his papers have been recognized as ESI Highly Cited Papers (in the Top 1% globally). He has also received honors, including the Jiangsu Provincial Government Scholarship for Overseas Studies.

Title: Microgels for Biomedical Applications

Abstract: While traditional bulk hydrogels have been extensively used in biomedicine, their utility as cell or therapeutic agents remains limited. Their macroscopic size often requires surgical implantation, and their dense nanostructure restricts cellular functions. In contrast, microgels — micron-scale hydrogel particles—offer notable advantages including a high specific surface area, enhanced mass transport, and the capacity for minimally invasive delivery. However, the broader application of microgels has been hindered by conventional fabrication methods, which frequently rely on harsh conditions such as high voltage, organic solvents, or surfactants. To overcome these limitations, we have developed a series of mild and biocompatible fabrication strategies based on gas-shearing and aqueous two-phase systems to produce highly monodisperse microgels. We further demonstrate the significant potential of these

microgels in facilitating tissue regeneration and treating intestinal diseases. Our results indicate that these microgels represent a promising and versatile platform for advanced therapeutic delivery and regenerative medicine.

Invited Speaker

09:20-09:40

Wanlu Li

Shanghai Jiao Tong University

Bio: Wanlu Li is a tenured-track Assistant Professor at the School of Biomedical Engineering, Shanghai Jiao Tong University. She received her Ph.D. in Biomedical Engineering from Shanghai Jiao Tong University and conducted visiting doctoral training and postdoctoral research at Harvard Medical School from 2018 to 2022. Her research focuses on developing human-relevant bioengineered platforms for studying cerebrovascular diseases and neural tissue regeneration, with particular emphasis on advanced 3D bioprinting and neurovascular modeling. She has published as first or corresponding author in leading journals, including Cell, Nature Communications, and Advanced Materials. Her work has been recognized by several international awards, including the International Stroke Conference Young Investigator Award (2019) and the International Society for Stem Cell Research (ISSCR) Outstanding Research Award (2020). She currently serves on the young editorial boards of Aging and Disease and Brain-X.

Title: Mechanically Programmable Bioprinting Enables Soft, Perfusable Human Tissues for Neurovascular Disease Modeling

Abstract: Digital light processing (DLP) bioprinting offers exceptional spatial resolution and geometric control, yet the fabrication of physiologically soft human tissues remains constrained by the trade-off between bioink printability and biologically relevant mechanical properties. Here, we present a mechanically programmable bioprinting strategy based on post-printing molecular cleavage, enabling the decoupling of printing fidelity from final tissue mechanics. Hyaluronic acid methacrylate (HAMA) is incorporated into gelatin methacryloyl bioinks to support high-resolution printing and is subsequently selectively degraded via enzymatic digestion, yielding tissue-matched softness while preserving architectural accuracy. Using this approach, we generate perfusable 3D tissues spanning a broad stiffness range, including brain-mimetic constructs with elastic moduli as low as ~1.3 kPa. Mechanical tuning significantly improves cell morphology, cytoskeletal organization, and functional maturation across multiple human cell types. Leveraging this platform, we further engineer a human 3D neurovascular unit (NVU)-on-a-chip featuring perfusable, branching vascular networks inspired by patient-specific cerebrovascular geometries. The system supports sustained perfusion and direct neurovascular interactions. By inducing localized thrombosis within a single vascular branch, we recapitulate unilateral focal cerebral ischemia in vitro and enable quantitative evaluation of thrombolytic therapies under physiologically relevant flow conditions. Collectively, this work establishes mechanically programmable bioprinting as a versatile strategy for engineering soft, perfusable human tissues and advancing human-relevant neurovascular disease models.

Invited Speaker

09:40-10:00

Mian Wang

Tongji University

Bio: Mian Wang is a Professor at the School of Life Sciences and Technology, Tongji University. His research focuses on the development of functional biomimetic tissues, organ-on-a-chip platforms, and in vitro models of maternal-fetal interactions. He was selected for the Shanghai Overseas High-Level Talent Program and the Pujiang Talent Program in 2022. Dr. Wang has led multiple competitive research projects, including a key subproject of the National Key Research and Development Program of China, as well as National Natural Science Foundation of China (NSFC) Programs. He has published over 40 SCI-indexed papers, including first or corresponding author publications in Cell, Nature Communications (2 articles), Science Advances, Advanced Materials (2 articles), and Advanced Functional Materials.

Title: Engineering Cell-Dense and Functional Human Tissues

Abstract: Bioprinting has emerged as a powerful approach for engineering functional living tissues; however, most hydrogel-based strategies remain limited by low cell densities, which restrict cell-cell interactions and compromise tissue-level functionality. Here, we introduce a fundamentally different bioprinting paradigm in which living cells at physiological densities are directly used as bioinks. By chemically modifying cell membranes with photo-crosslinkable acrylate groups, we enable photoactivated, layer-by-layer bioprinting of purely cellular constructs using digital light processing (DLP). This CeLl-dense bIoiNK (CLINK) strategy allows rapid fabrication of tissue constructs with ultrahigh cell densities (~109 cells mL-1), closely resembling native cellular architectures. The high cellularity and material-free nature of CLINK support robust tissue functions, enabling the generation of advanced biological models, including functional neural circuits and rhythmically contracting mini-cardiac tissues derived entirely from stem cells. Moreover, CLINK-fabricated implants exhibit the capacity to autonomously sense, adapt to, and integrate with host tissues, promoting tissue repair and regeneration. Together, this work establishes cellular bioink – based bioprinting as a powerful platform for constructing cell-dense, functional human tissues and expands the design space of tissue biofabrication toward more physiologically relevant architectures.

Invited Speaker

10:00-10:20

Xiaoxiao Han

Hunan University

Bio: Xiaoxiao Han is a Professor at Hunan University, China, and currently serves as Vice Dean for Undergraduate Education in the College of Mechanical and Vehicle Engineering. She obtained her M.Sc. and Ph.D. from the University of Leicester, UK, and previously held academic positions at the University of Warwick and Loughborough University. Prior to returning to China in 2019, she was a tenured Lecturer in Additive Manufacturing at

Loughborough University, where she led research in biocomposite additive manufacturing. Her research lies at the interface of biomanufacturing, additive manufacturing, biomaterials, and tissue engineering, with a focus on precision biofabrication, volumetric and light-based printing, biomimetic scaffold design, and AI-enabled design of biomedical devices. She has authored over 50 SCI-indexed papers in high-impact journals such as Nature Communications, Advanced Materials, Biomaterials, and Acta Biomaterialia, and holds multiple authorized invention patents. Her work is directed toward the development of advanced manufacturing strategies for regenerative medicine, personalized implants, and translational biomedical applications.

Title: Biomanufacturing of Functional Extracellular Vesicles and Biomimetic Spinal Microvasculature-Like Scaffolds for Spinal Cord Injury Repair

Abstract: Spinal cord injury (SCI) is a devastating traumatic disorder of the central nervous system that often leads to severe neurological dysfunction, permanent disability, and a substantial social and family burden. However, effective clinical treatments for promoting neural repair after SCI remain limited. In this talk, we present a biomanufacturing strategy that integrates functional extracellular vesicles (EVs) with biomimetic 3D-printed scaffolds for spinal cord regeneration. We first identify the functional heterogeneity of adipose stem/progenitor cells (ASPCs) from different adipose depots and highlight a DPP4-positive ASPC subpopulation derived from epidural fat as a promising cell source with neuroprotective potential. EVs secreted by this cell subpopulation exhibit typical vesicular characteristics and mediate significant neuroprotective effects. To further improve local delivery and regenerative microenvironment modulation, we developed a 3D-printed spinal microvasculature-like scaffold inspired by the native vascular architecture of the spinal cord. This biomimetic scaffold shows improved oxygen dispersion, favorable biocompatibility, and the capacity for sustained EV release. In vivo and in vitro studies demonstrate that the combination of DPP4-positive ASPC-derived EVs and the microvasculature-like scaffold promotes axonal regrowth, synaptic remodeling, neurogenesis, and functional recovery after SCI. Mechanistically, these therapeutic effects are associated with activation of the PI3K/AKT signaling pathway. Overall, this work establishes a new biomanufacturing paradigm that combines bioactive EVs with biomimetic scaffold design for spinal cord repair, offering a promising route toward advanced neural tissue engineering and translational regenerative therapy.

Technical Sessions

D4-AM-A11: Micro/Nanofabrication and Sensor

09:00-10:00, April 20, 2026 **Convention Hall F**

Session Chair: Jinchi Han, Peking University

09:00-09:15	**Paper ID:** Oral# 149 **Paper Title:** AI Empowered Mems Thermopile Array a Practical Approach for Target Detection with Commercial Off-the-Shelf Visual Models **Presenter:** Suoyang Zhang, East China Normal University
09:15-09:30	**Paper ID:** Oral# 236 **Paper Title:** A Deep Learning-Based Approach for Compensating Humidity Effects in Metal-Oxide Semiconductor Gas Sensors **Presenter:** Fei Wang, Southern University of Science and Technology
09:30-09:45	**Paper ID:** Oral# 266 **Paper Title:** Learning-Based Wafer-Scale Testing and Optimization of Mems Resonators **Presenter:** Xingyu Liu, The Hong Kong University of Science and Technology
09:45-10:00	**Paper ID:** Oral# 247 **Paper Title:** Next-Generation Smart Glucose Sensors Based on CMOS-Compatible Piezoelectric Substrates **Presenter:** Ali Imran, National Nanotech Innovation Center

Technical Sessions

D4-AM-A12: Micro/Nanofabrication Techniques and Devices

09:00-10:10, April 20, 2026 **Convention Hall C**

Session Chair: Xia Liu, Beijing Institute of Technology

Keynote Speaker

09:00-09:30 **Zaifa Zhou**

Southeast University

Bio: Prof. Zai-Fa Zhou received his PhD degrees in microelectronics and solid state electronics from Southeast University in 2009. After graduation with the highest honor, he joined the faculty of the Department of Electronic Science and Engineering, Southeast University. He was appointed as the deputy director in 2012 and the executive deputy director in 2018 of the Key Laboratory of MEMS of the Ministry of Education. He is currently employed as a distinguished professor of Jiangsu Province and also Southeast University. His current researches include MEMS/NEMS CAD, Design and integration of Microsystems, MEMS PCM, etc.. He has coauthored two scientific books, four chapters in scientific books, and more than 140 peer-reviewed international journal and conference articles. Prof. Zhou was the winner of the Second Class Prize of the State Scientific and Technological Progress Award (ranking 2, 2019), etc.. He has also served as TPC member for Asia-Pacific Conference of Transducers and Micro-Nano Technology (APCOT) from 2014.

Title: Optimization and Yield Analysis Method for MEMS Devices Based on Deep Neural Network Method

Abstract: The development of high-performance MEMS devices needs efficient design optimization and yield analysis in the presence of unavoidable process variations. The existing algorithms are difficult to integrate different requirements of optimization and uncertainty quantification (UQ), highlighting the necessity for a comprehensive algorithmic framework. This presentation proposes a novel algorithm framework for the optimization and UQ of MEMS devices. This approach is applied to several MEMS devices to verify its effectiveness.

Invited Speaker

09:30-09:50

Hao Jia

State Key Laboratory of Transducer Technology, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences

Bio: Hao Jia, Associate Professor of State Key Laboratory of Transducer Technology, Shanghai Institute of Microsystem and Information Technology (SIMIT). He received his Ph.D. degree in Electrical Engineering from Case Western Reserve University, USA. His research focuses on micro/nanoelectromechanical systems (MEMS/NEMS) sensors. He was the recipient of the High-Level Talent Award of the Ministry of Human Resources and Social Security, the Shanghai Leading Talent Award, and the Shanghai Pujiang Talent Award. He has published more than 60 peer-reviewed papers, including in Science Advances, Nano Letters, ACS Nano, etc. He has also applied for 13 patents, with 5 granted. He was also the recipient of the First Prize of the Shanghai Technology Invention Award, the Chinese Instrument and Control Society Innovation Achievement Award for Analytical Instruments, the Science Innovation Award, the Emerging Scholar Award, the Young Scientist Award Finalist, the Best Oral Presentation Award, and the Best Paper Award at international conferences. He is currently the youth editorial member for journals, Microsystems & Nanoengineering, Chip, etc.

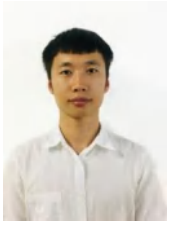
Title: MEMS Sensors for Differential Thermal Analysis

Abstract: Differential thermal analysis (DTA) stands as a pivotal thermal analysis technique in the realm of material characterization, with its significance spanning diverse fields like energy, environmental protection, and semiconductors. However, traditional bulky and expensive DTA instruments have faced the bottleneck of low sensitivity (~1-10 mV/W) and slow heating and cooling rates (~1 ℃ /s), thereby impeding the accuracy and efficiency in innovating functional nanomaterials. To address this challenge, we have developed a miniature MEMS sensor-based DTA technique thanks to the scalable fabrication. Through high-density integration of silicon thermocouples on a single microchip, the DTA sensors exhibit ultra-high sensitivity (~30mV/ ℃ , 100V/W) and ultra-fast heating and cooling rates (~105 ℃ /s), both representing significant improvements over the traditional DTA counterparts. Our high-performance MEMS sensors hold promise for next-generation rapid and precise DTA characterization for a wide range of applications.

Invited Speaker

09:50-10:10

Ruhao Pan



Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences

Bio: Ruhao Pan is currently an Associate Professor at Institute of Physics, Chinese Academy of Sciences (IOP). He received the Ph.D. degree in University of Academy of Sciences (UCAS) in 2019. And then he joined the IOP as a Postdoctoral. In 2021, he was recruited as a key technical expert to the IOP. His research field covers the Micro/Nano fabrication method, plasmonic devices, and optical metasurfaces. Pan has published 1 scientific book, more than 30 peer-reviewed papers (Physical Review Letters, Nature Communications, and Advanced Functional Materials, etc.) and contributed over 20 conference talks (META, ChinaNano, CPS, etc.), and authorized 9 invention patents. In recognition of his research accomplishment, he is selected as the Emerging Leaders by JMM, and won the prize of Outstanding Individual of the Technical Support System of the Chinese Academy of Sciences. He is also a guest editor of Micromichines.

Title: The Fabrication of Lithium Niobate Nanostructures With Their Applications in Optical Metasurface

Abstract: Lithium Niobate (LN) is called as the silicon of photonics for its superior optical properties including low loss over wide band, large nonlinearity, and high electrooptic coefficient, and is potentially utilized in the optical communication, quantum computing, etc. However, the top-down fabrication of the LN is challenged for its hardness and inactive chemical properties, further hindering its applications in optical devices. Here, we proposed an approach combined the e-beam lithography and reactive ion etching, where structures with linewidth down to 80 nm, sidewall slope of 86°, and high aspect ratio of 3:1. The method paves the way for designing diverse metasurfaces, and fascinating functions have been experimental demonstrated. For instance, metasurface that can enhance second harmonic generation, nonlinear metalens that can achieve focusing of ultraviolet light under the illumination of red light. Most importantly, by leveraging the intrinsic birefringence of LN, a chiral metasurface that based on achiral building blocks was constructed for the first time. The realization of LN metasurfaces show the extraordinary capacity of our fabricating method, and inspire crucial applications in optical field.

Technical Sessions

D4-AM-B01: Micro Biosensing and Micro Manipulation

10:30-11:40, April 20, 2026 **Meeting Room 301A**

Session Chair: Ye Tian, Northeastern University

Keynote Speaker

10:30-11:00 **Weixin Liu**

National University of Singapore

Bio: Weixin Liu is a Postdoctoral Research Fellow in the Department of Electrical and Computer Engineering at the National University of Singapore. His research spans nano-opto-electro-mechanical (NOEM) systems, silicon photonics, mid-infrared waveguide sensing, and microwave photonics. He received the B.Eng. in Mechatronics Engineering from Zhejiang University in 2019 and the Ph.D. in Electrical and Computer Engineering from NUS in 2024. Dr. Liu's first-author publications include Science, Nano Letters, Advanced Optical Materials, and Nanophotonics.

Title: Nano-Opto-Electro-Mechanical Gratings for On-Chip Light Switching and Spectral Shaping

Abstract: Programmable spectral shaping, i.e., dynamic and arbitrary control over spectra, promises to reshape photonic systems with unprecedented spectral efficiency and network agility. However, most existing photonic components offer rigid, weakly tunable spectral functions, constraining compact and high-speed on-chip implementations. This talk presents a pixelated nano-opto-electro-mechanical (NOEM) grating that leverages electromechanically induced symmetry breaking to achieve pixel-level, precise control of the grating coupling strength, enabling an ultracompact on-chip spectral shaper. The device combines a high degree of spectral programmability with fast, reconfigurable operation on a single chip, opening new routes toward elastic bandwidth allocation in optical networks and frequency-domain parallel optical signal processing. It also points to opportunities in optical computing, microwave photonics, and quantum photonics.

Invited Speaker

11:00-11:20 **Yunxing Lu**

Shanghai Open University

Bio: Yunxing Lu, graduated from State Key Laboratory of Transducer Technology, Shanghai Institute of Microsystem and Information Technology, now primarily engage in research related to micro/nano manufacturing and biomarker detection. Key projects include: National Natural Science Foundation of China: Integrated Digital PCR Chip for Multi-Target Detection of Lung Cancer-Related Exosomal LncRNAs (61971410) National

Key R&D Program: Nano-Integrated Devices and Reagents for Postoperative Efficacy Monitoring and Prognosis Analysis in Gastric Cancer (2017YFA02053002) National Key R&D Program: Selection of Bionic Materials for Scalable Stem Cell Cultivation and Intelligent Module Construction of Bioreactors (2018YFA0108202), leads the 2023 Shanghai Morning Light Program project titled "Early Tumor Diagnosis Using AI-Based Image Analysis of Exosomes."

The applicant has published first-author research papers in high-impact journals including Nano-Micro Letters, Biosensors & Bioelectronics, and Chinese Chemical Letters. Additionally, three conference papers were presented at the premier international sensor conference Transducer (2019, 2021, 2025), totaling more than 20 published papers. Three relevant patents have been granted.

Title: Research on Deep Learning Based Microfluidic Exosome Detection Analysis

Abstract: This report focuses on microfluidic exosome biomarker detection: a target detection model based on immunobridging. By autonomously constructing training datasets and integrating image recognition processing, we achieved fully automated, precise identification and quantitative analysis of exosome surface biomarker signals. Through these approaches, we have achieved intelligent analysis and data processing for exosome detection scenarios, providing core technological support for precise quantitative analysis and functional screening.

Invited Speaker

11:20-11:40

Aiwu Zhou

University of Electronic Science and Technology of China

Bio: Dr. Aiwu Zhou received his Ph.D. from Nanyang Technological University, Singapore, and is currently an Associate Research Fellow at the School of Integrated Circuit Science and Engineering, University of Electronic Science and Technology of China. His main research interests include the design and fabrication of ceramic composite photocurable materials, structural modeling and actuation control of magnetic miniature soft robots, additive manufacturing processes for three-dimensional integrated circuits, and the exploration of emerging mechanisms in next-generation additive manufacturing. Through long-term research in these interdisciplinary areas, he has built a solid academic foundation spanning materials design, process development, device integration, and application validation.

To date, Dr. Zhou has published 7 SCI papers and has been granted 3 invention patents. His research achievements cover multiple dimensions, ranging from fundamental studies of materials and manufacturing mechanisms to prototype system development and engineering-oriented application verification. He has also accumulated substantial experience in research commercialization, prototype equipment development, and multidisciplinary collaborative innovation, demonstrating strong potential in both academic research and technological translation.

Title: Intelligent Autonomous Droplet Manipulation with Magnetic Soft Millirobots for Sample-to-Answer Diagnostics

Abstract: In view In vitro diagnostics (IVD) tools are vital for early disease detection. Droplet liquid handling technologies offer a powerful means for miniaturized and integrated IVD assays, yet conventional droplet manipulation methods, such as magnetic digital microfluidics (MDM) faces limitations in autonomous 3D operations. In this work, we present an intelligent MDM platform using magnetic soft millirobots (MSMR) and artificial intelligence (AI)-based visual closedloop feedback, enabling autonomous 3D droplet manipulation for IVD. The MSMRs, structurally optimized through finite element analysis and fabricated using 3D printing, serve as dexterous grippers and pipettors for droplet manipulation. The computer vision system provides rapid and accurate visual perception, enabling real-time positioning, failure detection and rectification, and result interpretation for precise closed-loop feedback control. The platform demonstrates autonomous sample-to-answer Carba NP tests with accuracy matching golden standard. This intelligent MDM platform represents a significant step toward autonomous, reliable, and highly integrated laboratory systems for next-generation IVD.

Technical Sessions

D4-AM-B02: Micro/Nano Electro-Mechanical Systems (M/NEMS)

10:30-11:30, April 20, 2026 **Meeting Room 301B**

Session Chair: Xiaolong Wen, University of Science and Technology Beijing

10:30-10:45	**Paper ID:** Oral# 15 **Paper Title:** Research on a Photoelectric State Feedback System for MEMS Safe-and-Arming Devices **Presenter:** Xinyu Fan, Xi'an Jiaotong University
10:45-11:00	**Paper ID:** Oral# 54 **Paper Title:** Omnidirectional-Sliding Hybrid Nanogenerator for Sustainable Wireless Microsystems in IoT **Presenter:** Jingwen Liu, University of Electronic Science and Technology of China
11:00-11:15	**Paper ID:** Oral# 57 **Paper Title:** Mechanical-Thermal Hybrid Rotational Nanogenerator for Self-Powered Multi-Parameter Sensing in IoT Environments **Presenter:** Meng Xu, University of Electronic Science of Technology of China
11:15-11:30	**Paper ID:** Oral# 84 **Paper Title:** Towards Multi-Spectral Thermal Detection with Femto-Laser Processed Metasurface Pixels **Presenter:** Yuxuan Dong, Southern University of Science and Technology

Technical Sessions

D4-AM-B03: Micro Biosensing and Micro Manipulation

10:30-11:30, April 20, 2026 **Meeting Room 301C**

Session Chair: Renjie Zhou, The Chinese University of Hong Kong

Invited Speaker

10:30-10:50 **Xu Du**

Jiangsu University

Bio: Xu Du is an Associate Professor in the Department of Mechanical Engineering at Jiangsu University and has been selected for a talent program supported by China's Ministry of Education. He received his Ph.D. (Eng.) in Micro/Nano Mechanical Engineering from Nagoya University. His research focuses on robot-integrated microfluidic chips, single-cell manipulation and measurement, and micro-force sensors. He has published over 20 academic papers and holds more than 10 granted patents.

Title: On-Chip Fluid Control and Force Quantification for Single-Cell Mechanical Characterization

Abstract: The mechanical properties of cells are informative biophysical indices for evaluating cellular states and functions. Precise control of the extracellular flow field further enables single cells to be exposed to programmable chemical stimuli. Here, we report a microfluidic approach that integrates on-chip force sensing with a liquid switching function to quantify the dynamic mechanical response of a single cell under osmotic stimulation and to provide a quantitative readout that can be used to investigate mechanosensitive channel-related cellular responses.

We developed a closed silicon-based microfluidic chip in which a single cell is positioned and mechanically loaded by on-chip probes, while the reaction force and cell deformation are recorded synchronously. Liquid switching is achieved by controlling a laminar liquid–liquid interface in the measurement region. This platform captures time-resolved deformation dynamics and reaction force during osmotic downshock. To further improve liquid switching, we implemented synchronized injection–aspiration through a microprobe to form a pressure-balanced confined flow field around the target cell. This configuration enables millisecond-level liquid switching while maintaining stable force readout for reliable quantification of rapid transient cell responses. In addition, considering the fabrication complexity and cost of silicon MEMS chips, we performed an initial feasibility study of fully 3D-printed microfluidic chips with integrated force-sensing structures, aiming to simplify fabrication and expand access to single-cell force measurement.

Invited Speaker

10:50-11:10

Wei Wang

Westlake University

Bio: Wei Wang is an Assistant Professor at Westlake University, where he leads the Intelligent Microrobotics Laboratory. He earned his B.S. in Mechanics from Dalian University of Technology (2015), M.S. in Mechanics from Tsinghua University (2018), and Ph.D. in Mechanical Engineering from Cornell University (2024), followed by postdoctoral research at Cornell. His work focuses on microrobotics, with first/corresponding-author publications in Nature (cover), Nature Materials (cover), Science Robotics and et al, featured in Nature Physics, Nature Reviews Materials, and Scientific American and et al.

Title: Bioinspired Intelligent Cilia Robots

Abstract: This report will present the research achievements of Professor Wei Wang in the field of bioinspired intelligent cilia robots. Firstly, the report will cover the design and fabrication methods of micro/nano actuators based on mechanical design and nanofabrication technologies, with a focus on how to achieve fluid pumping functions through controllable deformation. Secondly, the report will introduce integrated circuits for cilia robots, including the design and manufacturing processes of integrated circuit-compatible cilia robots.

Invited Speaker

11:10-11:30

Bo Long

Fujian Agriculture and Forestry University

Bio: Bo Long is an Associate Professor, Director of the Department of Electronic/Agricultural Engineering, and Master's Supervisor at Fujian Agriculture and Forestry University (FAFU). He earned his Doctor of Engineering in Physical Electronics from Fuzhou University (2015), is pursuing postdoctoral research in Forestry Engineering at FAFU, and was a visiting scholar at Zhejiang University (2021-2022).

He teaches undergraduate and postgraduate courses like Intelligent Sensing and Detection Technology and Scientific Research Methods and Thesis Writing. He has presided over multiple teaching reform projects, winning the first prize in the National Young Teachers' Teaching Competition for Agricultural Engineering (2021), and titles such as FAFU "Excellent Teacher" (2025) and Fujian "Teaching Rookie" (2024).

His research focuses on biosensing materials/devices, aquatic disease detection, and food safety technology. He presides over 2 ongoing provincial projects, has completed 4 hosted ones, published over 15 SCI papers (many in JCR Q1, e.g., Advanced Composites and Hybrid Materials, IF=23.2), and holds 4 patents. He co-compiled 2 textbooks, committing to interdisciplinary innovation in agricultural engineering.

Title: Research and Application Exploration of Intelligent Agricultural Micro-Nano Sensors

Abstract: This report focuses on the research and application exploration of intelligent agricultural micro-nano sensors, aiming to provide technical support for agricultural information sensing and precision farming. It mainly covers four core research directions, including covalent organic framework (COFs) electrochemical sensors for antibiotic detection, carbon-based composite film sensors for antibiotic residue detection, intelligent sensing technology applied in mariculture, and COF humidity film wearable sensors.

The research achieves innovations in sensor materials and device integration, such as developing high-sensitivity and specific COFs composite-based electrochemical sensors, and integrating sensors with embedded devices to realize portable on-site detection. It also involves the application of sensing technology in water quality parameter intelligent prediction and sea cucumber culture monitoring, with relevant research results published and patents authorized, contributing to interdisciplinary innovation in agricultural information sensing technology.

Technical Sessions

D4-AM-B04: Emerging Mico/Nano Technologies

10:30-12:20, April 20, 2026 **Meeting Room 302A**

Session Chair: Tianxun Gong, University of Electronic Science and Technology of China

Keynote Speaker

10:30-11:00 **Tie Li**

State Key Laboratory of Transducer Technology, Shanghai Institute of Microsystem and Information Technology,

Chinese Academy of Sciences, China

Bio: Tie Li is currently a Professor in Shanghai Institute of Microsystem and Information Technology, CAS. He has published over 200 papers on Nano Letters、Small、Carbon、IEEE EDL etc., and owned 75 Chinese patents， 1 Japan Patent and 3 US Patents. His research interests include design, fabrication and application of Micro and Nano sensors.

Title: NDIR CO2 Gas Sensor: Much Smaller and More Powerful

Abstract: Non-dispersive infrared (NDIR) method is distinguished from others by its long lifetime, high sensitivity, and stability, as a powerful method to detect CO2 gas. NDIR system mainly consists of three parts, the optical chamber, the light source, and the infrared detector. Most researchers have improved the compactness of the NDIR CO2 gas sensor mainly by optimizing its chamber structure as the size of the optical chamber largely determines the overall size of the sensor. Unfortunately, this strategy has a significant limitation due to the large package size of the light source and the detector itself. The forced reduction of the optical chamber size on this basis usually complicates the light transmission path, and the excessive number of reflections reduces the intensity of the IR light signal received at one end of the detector. In our work, compact CO2 infrared gas sensors are developed. A MEMS emitter chip with improved high emissivity, an optical chamber with high coupling efficiency, and a thermopile chip with high detectivity are used improve the performance of the sensor,which is similar to the one currently available in the market.

Invited Speaker

11:00-11:20 **Binghao Wang**

Southeast University

Bio: Binghao Wang is currently a Professor in the School of Electronic Science and Engineering at Southeast University. Previously, he served as a Project Researcher at the University of Tokyo, and as a Joint PhD student and Postdoctoral Researcher at Northwestern University. He received his B.E., M.S., and PhD degrees from Soochow

University. His research focuses on ultra-thin flexible transistor-integrated circuits and multifunctional sensing systems. He has co-authored more than 90 papers in prestigious journals including Nature Electronics, Nature Communications, Science Advances, and PNAS. He currently serves as an Associate Editor for Wearable Electronics and the Chinese Journal of Sensors and Actuators.

Title: Ultraflexible Photoelectrical Impedance Tomography-based Imager for 3-Axis Robotic Tactile Sensing

Abstract: Three-axis tactile sensing has become pivotal for intelligent robotics in complex tasks ranging from force decoupling to adaptive grasping. Optical-based tactile sensing inherently provides superior spatial resolution, rich multimodal data, and electromagnetic interference resistance. However, conventional optical-based tactile sensors employing rigid CMOS imagers suffer from limitations in mechanical flexibility, large-area scalability, and manufacturing costs. Here we present an ultraflexible photoelectrical impedance tomography (PIT) imager that achieves high-fidelity three-axis tactile sensing through radical device simplification-reducing output connections by orders of magnitude compared to conventional imagers. The 5 μm-thick PIT imager integrates CdSe/ZnS quantum dots/indium-zinc-oxide heterojunction layer with 16 peripheral electrodes, demonstrating exceptional optoelectronic characteristics including > 10^4 photo-to-dark current ratio and cycling stability under UV light irradiation. Additionally, the PIT imager achieves spatiotemporal sensing, resolving 1.5 mm spatiotemporal resolution with fewer interconnects (pixel to interconnect ratio > 80) and tracking up to five simultaneous UV patterns. The ultrathin device maintains stable performance under extreme mechanical deformation (bending radius of 0.3 mm) and even survives after puncture. Through the integration of light-scattering porous rubber and LED arrays, we enable triaxial force decoding via Gaussian-distributed photocurrent analysis, achieving: an 80 kPa dynamic range with an averaged sensitivity of 0.04 kPa^{-1} to normal force, a 0.17 μm kPa^{-1} shear displacement resolution, and 96.5% multimodal recognition accuracy for simple topologies using a ResNet-18 architecture. We foresee this technology for next-generation haptic interfaces in soft robotics, neuromorphic prosthetics, and immersive human-machine interaction systems.

Invited Speaker

11:20-11:40

Haitao Deng

University of Electronic Science and Technology of China

Bio: Haitao Deng is currently a Postdoctoral Fellow at the University of Electronic Science and Technology of China (UESTC), China. She received the Ph.D. degree in Electronic Science and Technology from UESTC in 2023, and then served as a Project Researcher (特任研究員) at The University of Tokyo, Japan. Her research focuses on Micro-Electro-Mechanical Systems (MEMS), covering flexible/stretchable electronics, micro/nano manufacturing, multi-functional sensor and its integrated microsystems.

Title: Micro/Nano-Scale Porous Structures Empowering Flexible Multifunctional Sensors

Abstract: Flexible sensors have emerged as a pivotal technology for seamless integration with curved surfaces and biological interfaces, enabling human-machine interaction and personalized health

monitoring. Widely applied in wearable biosensors, electronic skin, and others, they support physiological signal tracking or biomarker detection. Porous micro/nanostructures boost sensor sensitivity, response speed, breathability by optimizing mechanical deformation and ion/electron transport. However, their fabrication suffers from complex processes, high costs, and poor structural tunability, limiting large-scale application. While additive manufacturing, template-assisted electrodeposition, and chemical etching, have emerged to address these issues, further optimization of structure-property relationships remains essential for practical deployment. This talk will introduce effective, facile methods for fabricating micro/nano porous structures with highly interconnected pore network and tunable distribution, as well as how such porous architectures can endow flexible sensors with multi-sensing capabilities for wearable healthcare applications. As examples, a method for fabricating elastic, highly-interconnected, micro-scale porous structures is proposed, overcoming the key limitation of traditional sacrificial template methods (i.e., the easy formation of closed pores) through the introduction of hot steaming process. The micro-porous structure grants the sensing layer good mechanical self-recovery and strain response characteristics, realizing the multi-functional integration of pressure, temperature, and motion monitoring in an elastic film. Besides, a nano-scale gradient porous microneedle array is fabricated using a phase inversion method. It addresses the intrinsic strength-porosity trade-off of conventional porous microneedles, integrates efficient, spontaneous fluid sampling and on-site biomarker detection on a flexible patch, and, paired with a customized signal calibration module, establishes a microneedle sensing system for personalized health monitoring and diagnosis.

Invited Speaker

11:40-12:00

Sihai Luo

Xi'an Jiaotong University

Bio: Prof. Sihai Luo holds joint appointments as a tenured faculty member and PhD supervisor at the Institute of Frontier Science and Technology, School of Mechanical Engineering, and the First Affiliated Hospital of Xi'an Jiaotong University. He is a distinguished awardee of the National Young Talent Initiative (Overseas) and the Class A Young Elite Scholar Program of Xi'an Jiaotong University.

He obtained his Master’s degree from Politecnico di Milano in 2017, before completing his doctoral research at the Norwegian University of Science and Technology. After graduating with a PhD, he worked as a postdoctoral researcher at NTNU and then as a senior research fellow at the Paul Scherrer Institute in Switzerland, where he led a research project on EUV interference lithography sponsored by ASML.

His current research interests lie in advanced nanofabrication and intelligent sensing systems. To date, he has secured two grants from the National Natural Science Foundation of China, and published over 20 peer-reviewed papers in leading journals such as Advanced Materials, ACS Nano and Advanced Functional Materials. He also serves as a Young Editorial Board Member for International Journal of Extreme Manufacturing (IF=21.4, CAS Q1) and Microsystems & Nanoengineering (IF=9.9, CAS Q1).

Title: Wafer-scalable Artificial Synapses and Logic Gate Circuits Based on Coplanar Self-Aligned-Gate Organic Transistors for Artificial Vision Applications

Abstract: Wafer-scale and low-voltage operation are essential for practical artificial vision hardware. Here, we report a wafer-scalable artificial synapse and logic gate circuits platform based on coplanar self-aligned-gate (SAG) organic transistors using the narrow-bandgap semiconducting polymer DPP-DTT and self-assembled monolayer as dielectric. Coplanar SAG electrodes effectively suppress parasitic effects due to the reduction of gate-to-contact overlaps, enabling uniform transistor operation at low voltages (-6 to 2 V) across the wafer, delivering a high rectification ratio of 2.46 × 10^5. Under near-infrared illumination, the devices exhibit efficient phototransduction and reconfigurable modulation of synaptic plasticity between excitatory and inhibitory modes, with an ultra-low energy consumption of 5.28 fJ per event. In addition, minimal circuit configurations enable electrically driven NOT and NOR logic gates circuits as well as optical-electrical hybrid-input NOR logic operations, enabling maximize and simplifying the functionality of photosensing logic circuits. Furthermore, an artificial neural network constructed based on the SAG transistors further demonstrate the potential applications in handwritten digit recognition with a recognition accuracy of ~96% and image memory behavior. This work provides a scalable and effective path for developing low-power artificial synapses to neuromorphic artificial vision systems.

Invited Speaker

12:00-12:20

Junzhuan Wang

Nanjing University

Bio: Prof. Junzhuan Wang is a distinguished faculty member at the School of Electronic Science and Engineering, Nanjing University, China. She received her B.S. degree in 2001 and Ph.D. degree in Microelectronics and Solid-State Electronics in 2008, both from Nanjing University. From 2009 to 2011, she worked as a postdoctoral researcher at LPICM, Ecole Polytechnique (CNRS), France, where she gained extensive experience in advanced nanofabrication and thin-film technologies. Prof. Wang's primary research interests lie in silicon nanowire field-effect transistors (FETs) and nano-electromechanical systems (NEMS). Her work focuses on the development and integration of post-Moore silicon nanowire devices, including high-performance FETs for future logic applications and NEMS devices for sensing and signal processing. She is also actively involved in the design of on-chip integrated spectrometers leveraging nanowire architectures. As a principal investigator, Prof. Wang has led multiple projects funded by the National Natural Science Foundation of China (NSFC) as well as key research tasks under China's National Key Research and Development Program. She has published over 50 peer-reviewed SCI papers in leading international journals, including Nature Communications, Science Advances, and Nano Letters, making significant contributions to the field of nanoscale silicon devices and systems.

Title: A Multifunctional Intelligent Micro-Nanorobot System Based on Programmable Nanowires

Abstract: This report summarizes recent advances in silicon nanowire (SiNW)-based nanoelectromechanical systems (NEMS) and robotic devices, developed through designable in-plane solid-liquid-solid (IPSLS) growth and Lorentz force (LF) actuation. First, a bidirectional LF-actuated NEM switch is demonstrated, featuring an ultralow operation voltage (<0.2 V) and a large air gap (~7.8 μm) that ensures excellent electrical isolation while overcoming stiction issues, achieving an ON/OFF ratio >10^{10} and subthreshold swing down to 1.1 mV/dec. Second, ultracompact single-nanowire-morphed grippers are realized, capable of large-amplitude grasping, flapping, twisting, and high-frequency resonant vibrations for reliable micro-object manipulation, including collaborative hand-to-hand transfer and on-site micro-LED picking, testing, and installation. Third, a mechanical slingshot constructed from meandering SiNW springs enables directional shooting of micro-payloads, with stored strain energy an order of magnitude higher than straight springs, effectively overcoming van der Waals forces for precise delivery onto low-surface-energy targets, including biological cells. Collectively, these works establish a versatile platform for integrating high-performance NEMS logic, memory, sensors, and robotic actuators operable at CMOS-compatible voltages and in harsh environments.

Technical Sessions

D4-AM-B05: Micro/Nano/Molecular Physical/Chemical Sensors/Actuators

10:30-12:00, April 20, 2026 **Meeting Room 302B**

Session Chair: Tao Luo, Xiamen University

10:30-10:45	**Paper ID:** Oral# 6 **Paper Title:** High Precision MEMS Piezoresistive Pressure Sensor for SF6 Digital Density Meter in Power Grid System **Presenter:** Dongming Fang, Beijing SmartChip Microelectronics Technology Co., Ltd.
10:45-11:00	**Paper ID:** Oral# 20 **Paper Title:** Finite-Element-Based Modeling and Design Principles for High-Performance Metal Oxide Semiconductor Gas Sensors **Presenter:** Zhiqiao Gao, Beijing Institute of Technology
11:00-11:15	**Paper ID:** Oral# 40 **Paper Title:** A MEMS Thermometer Based on a Differential TETF AlN-on-Si Resonator Pair **Presenter:** Yunfei Xie, University of Electronic Science of Technology of China
11:15-11:30	**Paper ID:** Oral# 50 **Paper Title:** Liquid-Film-Rupture – Driven Ag Nanowire Microarrays for Transparent MEMS Sensors **Presenter:** Yao Tan, University of Electronic Science and Technology of China
11:30-11:45	**Paper ID:** Oral# 53 **Paper Title:** A Compact Flexible Multimodal Sensor with Orthogonal Electrical Parameter Decoupling for Health and IoT Monitoring **Presenter:** Jiafeng Zhao, University of Electronic Science and Technology of China
11:45-12:00	**Paper ID:** Oral# 66 **Paper Title:** A 3D-Printing-Enabled Monolithic Electronic Skin for Multimodal Sensing **Presenter:** Bingyu Zou, ShanghaiTech University

Technical Sessions

D4-AM-B06: Non-linear Mechanisms Enabled M/NEMS

10:30-12:00, April 20, 2026 **Meeting Room 305**

Session Chair: Xueyong Wei, Xi'an Jiaotong University

Invited Speaker

10:30-11:00 **Ronghua Huan**

Zhejiang University

Bio: Huan Ronghua is a Professor and Doctoral Supervisor at Zhejiang University, serving as the Deputy Director of the Institute of Applied Mechanics. He concurrently holds several academic positions, including Deputy Chairman of the Technical Committee on Random Vibration under the Chinese Society for Vibration Engineering, Member of the Technical Committee on Dynamics and Control under the Chinese Society of Theoretical and Applied Mechanics, Deputy Leader of the Professional Group on Stochastic and Neural Dynamics, Council Member of the Zhejiang Society of Theoretical and Applied Mechanics, and Chairman of the Technical Committee on Dynamics and Control under the Zhejiang Society of Theoretical and Applied Mechanics. His research interests include nonlinear stochastic dynamics, random vibration control, active/passive vibration damping, microsystem dynamics, and precision sensing. He has published over 100 journal papers and has been granted more than 10 invention patents. As the principal investigator, he has led projects such as the General Program of the National Natural Science Foundation of China, the National Key Research and Development Program, the National Science and Technology Support Program, the "973" Program, the Key Program of the Zhejiang Provincial Natural Science Foundation, military research projects, and industry-commissioned research projects.

Title: Nonlinear Enhancement of Mode Localization Sensitivity in Micro-Resonators

Abstract: The mode localization phenomenon, owing to its high sensitivity to parametric perturbations, holds significant promise for applications in the field of MEMS sensing. It has been successfully utilized in the design of high-performance sensors for electric charge, acceleration, and mass. However, due to scaling effects and multi-physics field coupling, micro-mechanical resonators can easily be driven into the nonlinear vibration regime during operation. In a recent study, our research group discovered that the appropriate utilization of nonlinear effects can effectively enhance the sensitivity of mode-localized sensing. Specifically, the research reveals that a softening nonlinearity can enhance the localization of the in-phase mode, while a hardening nonlinearity significantly enhances the localization of the out-of-phase mode. Based on this principle, we have designed a novel mode-localized electrometer that leverages these nonlinearities, substantially improving the resolution and accuracy of charge sensing. This research provides a new paradigm for the design of high-performance MEMS sensors.

Invited Speaker

11:00-11:20 **Jie Song**

Jiangsu University

Bio: Dr. Jie Song is a lecturer in the School of Mechanical Engineering at Jiangsu University. She earned her Ph.D. from Jilin University in 2022. Between November 2019 and March 2021, she conducted research as an exchange student at Tohoku University in Japan. Her research focuses on vibration energy harvesting, nonlinear dynamics, and self-powered resonant sensors. Dr. Song has authored over 10 publications in leading journals including Energy Conversion and Management, Mechanical Systems and Signal Processing, IEEE Sensors Journal, and Smart Materials and Structures. Her work primarily explores MEMS-based low-frequency vibration energy harvesting and the design of integrated devices for energy concentration and sensing.

Title: Vibration Energy Harvesting and Self-Powered Sensing via Nonlinear Strategies in Multi-Scale Devices

Abstract: Addressing the power supply challenge for sensors can significantly reduce the spatial and cost constraints of wireless sensor nodes. Vibration energy — a pervasive source in our environment — is typically characterized by wide bandwidth and low frequency. However, vibration energy harvesters with complex mechanical designs are often incompatible with Micro Electro Mechanical Systems (MEMS) fabrication and difficult to integrate with miniaturized sensors. Thus, achieving efficient low-frequency vibration energy harvesting at a microscale remains a considerable challenge. In this presentation, I will share several low-frequency vibration energy harvesting and sensing systems developed by our research team. These systems incorporate theoretical frameworks ranging from bistable to stiffness-parametric coupling, span device scales from mesoscopic to microscopic, and integrate functions from energy harvesting to self-powered sensing. I will detail and analyze the design principles, operational mechanisms, modeling approaches, and relevant experimental outcomes.

Invited Speaker

11:20-11:40 **Yuxuan Jiang**

Anhui University

Bio: Dr. Yuxuan Jiang received the B.S. degree in physics from Peking University, Beijing, China, and the Ph.D. degree in condensed matter physics from Georgia Institute of Technology, Atlanta, U.S.A. He was a Jack Crow Postdoc Fellow in National High Magnetic Field Laboratory, Tallahassee, U.S.A., and now is currently a professor in school of physics in Anhui university, Hefei, China. His research interests include optical spectroscopy in quantum materials and nonlinear dynamics phenomena in NEMS/MEMS.

Title: Revealing Sideband Effects in a Nonlinear Membrane Resonator With Multi-Tone Measurements

Abstract: Recently, there has been increasing interest in the sideband response of resonantly driven nonlinear modes, as it is closely related to squeezing effects that allow the system to surpass conventional noise limits and holds important implications for technological applications. Hence, it is of great importance to understand their behavior under external stimuli and to achieve control over these sidebands. In this talk, I will first present a novel sideband effect in a driven nonlinear mode whose eigenfrequency is modulated at a low frequency (<1 kHz). This additional parametric modulation leads to prominent antiresonance line shapes in the sideband spectra, which can be controlled through the vibration state of the driven mode. Our model analysis establishes a direct connection between the antiresonance frequency and the squeezing of thermal fluctuations in the system. Moreover, as the strength of the probe tone increases, we observe a Duffing-like lineshape and multiple sidebands emerging at their overtones frequencies. These results strongly indicate that the sideband response evolves into a nonlinear regime and becomes highly coupled.

Invited Speaker

11:40-12:00

Fan Yang

Dynamic Precision Micro & Nano Sensing Technology Research Institute, Chongqing

Bio: Fan Yang, PhD, Researcher, Chief Scientist in Dynamic Precision Micro&Nano Sensing Technology Research Institute, Chongqing, China. He graduated as Dr. rer. nat. (Phyiscs) at the University of Konstanz in Germany in 2020. He is focusing on the research of strongly driven nonlinear dynamics, fluctuations in multi-dimensional advanced MEMS/NEMS, 2D material integrated MEMS/NEMS devices, and the R&D of high precision optical vibrometry.

Title: Nonlinear Behavior of 2D Material Empowered MEMS/NEMS Silicon Based Devices

Abstract: Integration of graphene in silicon-based micro-/nanoelectromechanical systems (MEMS/NEMS) marries the robustness of silicon-based materials with the exceptional physical properties of graphene, drastically enhancing the system ' s regulation performance which now is key for many advanced applications in nanotechnology. Here, we demonstrate a powerful on-chip integration principle consisting of a hybrid graphene/silicon nitride membrane with metallic leads on top that enables an extremely large static and dynamic parameter regulation. The flexible combination of static and AC voltage is applied to

localize the electrothermomechanical (ETM) effect, achieving ultra-wide frequency tuning, deformation (buckling transition), regulation of the mechanical properties, and exciting the resonator vibrating even far beyond its linear regime. It proves that the scheme provides a compact integrated system possessing mechanical robustness, high controllability, and fast response. It not only expands the limit of the application range of MEMS/NEMS devices, but also enables their further miniaturization.

Technical Sessions

D4-AM-B07: Piezoelectric and Acoustic MEMS	
11:00-11:30, April 20, 2026	**Meeting Room 306**
Session Chair: Xianhao Le, Yongjiang Laboratory	

11:00-11:15	**Paper ID:** Oral# 181 **Paper Title:** Piezoelectric Acoustic Surfaces for Sound Localization **Presenter:** Jinchi Han, Peking University
11:15-11:30	**Paper ID:** Oral# 210 **Paper Title:** Analytical Electromechanical Model of Curved Piezoelectric Bimorph Beams **Presenter:** Junning Zhang, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

Technical Sessions

D4-AM-B08: Biomimetic Microelectromechanical Systems (MEMS) Technology

10:30-12:00, April 20, 2026 **Meeting Room 307**

Session Chair: Yonggang Jiang, Beihang University

D4-AM-B08: Biomimetic Microelectromechanical Systems (MEMS) Technology

10:30-12:00, April 20, 2026 **Meeting Room 307**

Session Chair: Yonggang Jiang, Beihang University

Keynote Speaker

10:30-11:00 **Guojun Zhang**

North University of China

Bio: Guojun Zhang received the Ph.D. degree from Northwestern Polytechnical University, China, in 2015. He is currently a Professor with the School of Instrument and Electronics, North University of China, and serves as the Deputy Director of the State Key Laboratory of Extreme Environment Optoelectronic Dynamic Measurement Technology and Instrument at North University of China. His current research interests include MEMS technology, acoustic transducers, and sensing systems.

Title: Biomimetic MEMS Vector Hydrophones and Applications

Abstract: MEMS biomimetic vector hydrophones are inspired by the lateral line system and hair-cell structures of aquatic organisms and have attracted significant attention for underwater acoustic sensing due to their small size, high sensitivity, directional capability, and ease of integration. This work reviews the development and application of MEMS-based micro/nano hydrophones, focusing on three representative types: biomimetic vector hydrophones, optical microcavity hydrophones, and piezoelectric thin-film hydrophones. Among them, the biomimetic vector hydrophone mimics biological hair-cell sensing mechanisms to detect acoustic pressure or particle velocity. Its key research aspects include sensing mechanisms, biomimetic structural design, micro/nano fabrication technologies, packaging and calibration, and typical application scenarios. Optical microcavity hydrophones achieve high sensitivity through resonant cavity structures, while piezoelectric thin-film hydrophones convert acoustic signals into electrical responses using piezoelectric materials, providing alternative approaches for miniaturized underwater acoustic sensors.

In practical applications, MEMS biomimetic vector hydrophones can be integrated with turbulence sensors and buoy-based microsystems to form compact ocean monitoring platforms. Such systems typically include acoustic modules, navigation components, surface and underwater electronic units, and

signal processing and direction-finding algorithms. Through integrated fabrication, environmental testing, and performance evaluation, these systems enable underwater acoustic detection and turbulence measurements. The results demonstrate that MEMS biomimetic vector hydrophones offer promising potential for compact, low-power, and high-performance underwater sensing systems.

Invited Speaker

11:00-11:20

Zhiqiang Ma

Beihang University

Bio: Zhiqiang Ma is currently an Associate Professor at the School of Mechanical Engineering and Automation, Beihang University. He received his Ph.D. degree from Beihang University in 2021, after which he served as a Postdoctoral Fellow at City University of Hong Kong from 2021 to 2025. His current research interests mainly include on biomimetic sensing, soft Micro-electromechanical Systems (MEMS), Micro/Nano fabrication, and flow field detection. He has published over 30 papers in leading international journals such as Advanced Materials, Advanced Functional Materials (4, including 1 cover), Advanced Science (3, including 1 cover), ACS Nano (cover) etc. Dr. Ma is the recipient of several honors, including the Gold Award of the Asian International Innovation and Invention Awards, the Rising Stars of Newton (a sister journal to Cell), the Second Prize of the China Medical Device Innovation and Entrepreneurship Competition, and the Hong Kong Innovation and Technology Commission's Talent Support Program. He also serves as a Young Editorial Board Member for journals such as Research (a science partner journal, Impact Factor: 10.9) and Nano-Micro Letters (Impact Factor: 36.3).

Title: Bio-Inspired Smart Vascular Grafts for in Situ Continuous Monitoring of Hemodynamics

Abstract: Vascular grafts, widely employed in the management of cardiovascular diseases (CVDs), remain susceptible to postoperative complications. Native blood vessels possess the intrinsic ability to perceive hemodynamics in real time, thereby maintaining physiological homeostasis. Inspired by this biological sensing capability, smart vascular grafts (SVGs) have been developed through the integration of flexible bioelectronics with conventional vascular grafts, aiming to enable real-time monitoring of hemodynamics and vascular health. Nevertheless, the clinical translation of SVGs faces persistent challenges, particularly in achieving biomechanical compatibility, promoting endothelialization, and enabling accurate evaluation of vascular status.

To address these limitations, we first present an all-in-one piezoelectric SVG (PE-SVG) device, constructed by encapsulating a polyvinylidene fluoride (PVDF) nanofiber mat patterned with silver nanowire electrodes between two layers of polycaprolactone nanofiber mats. The resulting device exhibits mechanical properties comparable to those of native blood vessels and supports enhanced endothelialization. Furthermore, the integrated piezoelectric PVDF nanofiber endows the PE-SVG with outstanding capability for real-time hemodynamic sensing.

In addition, employing a sheet rolling technique, we developed a piezoresistive SVG (PR-SVG) device by encapsulating patterned porous graphene as strain-sensing elements within biocompatible PDMS. The

PR-SVG not only retains favorable mechanical performance and endothelialization capacity but also enables accurate detection of hemodynamics. Based on the collected hemodynamic data, the PR-SVG device allows for assessment of blockage morphology and localization within an in vitro simulation platform. Moreover, in vivo animal studies demonstrate that the PR-SVG achieves clinically relevant accuracy in hemodynamic monitoring and reliable diagnostics of vascular health. Collectively, these developed SVG devices represent a significant advancement toward precision hemodynamic monitoring and timely diagnosis of vascular disorders in the context of next-generation vascular healthcare.

Invited Speaker

11:20-11:40

Shiqiang Liu

Tsinghua University

Bio: Shiqiang Liu is currently an Assistant Professor at Tsinghua University. He received his Ph.D. degree in Instrumentation Science and Technology from Tsinghua University in 2018. Subsequently, he joined the Department of Precision Instruments at Tsinghua University as an Assistant Research Fellow, and also worked as a Postdoctoral Research Associate at the Department of Clinical Neurosciences, University of Cambridge. His research interests include MEMS and flexible sensors, as well as their applications in wearable health monitoring, human-robot interaction, and intelligent control of wearable robots.

Shiqiang Liu has published research papers in highly-reputable journals (Sci. Adv., Nat. Commun., Adv. Sci., Adv. Funct. Mater., Natl. Sci. Rev., InfoMat, etc.). Dr. Liu was awarded the Second Prize of the Ministry of Education Natural Science Award for Outstanding Scientific Research Achievements (2025), the First Prize of the National Invention and Entrepreneurship Award -Project Category (2024), and the Gold Medal at the National Invention Exhibition (2024), among other honors. Dr. Liu currently serves as a Youth Editorial Board Member of the highly-reputable journal Exploration and holds several academic memberships, including Senior Member of the Chinese Instrument and Control Society, Senior Member of the Chinese Society of Micro-Nano Technology, and Member of IEEE.

Title: A Smart Headband for Multimodal Physiological Monitoring in Human Exercises

Abstract: Wearable multimodal physiological monitoring plays a crucial role in sports training and contest, personalized health management, and exercise rehabilitation. However, challenges in continuous and accurate physiological signal acquisition, motion artifact in human exercises, and wearable convenience with multimodal integration, hinder its practical applications. Here, we propose a smart headband using a thermal-sensation-based electronic skin (e-skin) for continuously and accurately monitoring multimodal physiological parameters, including pulse pressure waveform, total metabolic energy cost, heart rate, and forehead temperature. The headband allows accurate and continuous monitoring under both static and dynamic conditions for indoor and outdoor activities in real life. The effectiveness and robustness of multimodal physiological monitoring is validated across various human activities including resting, walking, jogging, bicycling, hill climbing and even long-distance running.

Significant physiological variations with fatigue are uncovered, potentially revealing rich information about cardiac load, cardiovascular condition, and potential risk.

Invited Speaker

11:40-12:00

Xingxu Zhang

Northwestern Polytechnical University

Bio: Xingxu Zhang was born in Liaoning Province, China, in 1994. He received the B.E., M.E. and Ph.D. degrees from the School of Mechatronics Engineering at Harbin Institute of Technology, Harbin, China, in 2014, 2016, and 2021, respectively. Besides, he was a joint PhD candidate in the School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore, from 2017 to 2019. He is currently an Associate Professor with the School of Mechanical Engineering, Northwestern Polytechnical University. And he is also a member of the Ministry of Education Key Laboratory of Micro and Nano Systems for Aerospace. He has led over ten research projects including the General Project of National Natural Science Foundation of China, the Youth Science Fund Project (Class C) of National Natural Science Foundation of China, the Sub project of National Key Research and Development Program, and so on. Besides, he has published over 30 high-level academic papers. His research interests include Flow Measurement Microsystems, Piezoelectric Devices, and Bionic Sensing Technology.

Title: Biomimetic Harbor Seal Whisker MEMS Sensor for Underwater Wake Vortex Detection

Abstract: Accurate perception of underwater targets is essential for ensuring the efficient operation of UUVs. Microsensors based on MEMS technology, characterized by small size, light weight, and ease of integration, offer new technological solutions for underwater flow-field sensing. Harbor seals are capable of detecting subtle hydrodynamic trails left by prey using their highly sensitive whiskers, and this unique biological sensing mechanism provides important inspiration for the development of biomimetic flow sensors. Current research on bionic seal whisker sensors has primarily focused on analyzing the hydrodynamic characteristics of isolated whisker models, with limited investigation into the overall fluid-structure interaction (FSI) mechanism of devices integrating whiskers with sensitive structures. Additionally, existing bionic whisker models are generally large in scale, exhibiting significant differences from real seal whiskers in both dimensions and dynamic properties, which compromises the device's ability to perform precise detection of flow fields. To address these issues, this study conducts systematic research on the structural design, FSI mechanisms, microfabrication, and underwater performance testing of bionic seal whisker microsensors. Focusing on the operational principle of the microsensor, this study analyzes the influence of key structural parameters on stress distribution and natural frequencies. An FSI model of the sensor was established to analyze velocity and pressure field distribution characteristics and structural response properties under various operating conditions. Fabrication and packaging integration of the bionic seal whisker microsensor are investigated. Experimental testing was conducted to validate the sensor's vortex-induced vibration suppression and wake vortex detection capabilities. The transverse vibration amplitude of the bionic seal whisker microsensor was much smaller than that of cylindrical and elliptical columns. Under wake flow conditions, the microsensor successfully identified the dominant frequency of wake vortices generated by upstream obstacles with an average detection error below 6%.

The microsensor can distinguish between different obstacle shapes, characteristic dimensions, and flow velocities, and can detect upstream obstacles at varying distances. This work provides novel theoretical foundations and technical solutions for underwater flow field sensing and target detection.

Technical Sessions

D4-AM-B09: Surface/Interface Functional Electronics

10:30-11:50, April 20, 2026 **Meeting Room 308**

Session Chair: Yanchao Mao, Zhengzhou University

Invited Speaker

10:30-10:50

Fengru Fan

Xiamen University

Bio: Dr. Fan is a Professor at the College of Chemistry and Chemical Engineering, Xiamen University, and a recipient of the National Science Fund for Excellent Young Scholars (2022). He obtained his B.S. (2006) and Ph.D. (2013) from Xiamen University under the supervision of Academician Zhong-Qun Tian. During his doctoral studies, he conducted joint research at the Georgia Institute of Technology (2008 – 2012) with Professor Zhong Lin Wang, where he was among the early researchers exploring triboelectric nanogenerators (TENGs). He later worked as a postdoctoral researcher at the University of California, Santa Barbara (2016 – 2019) with Professor Galen D. Stucky. His research focuses on the design and physicochemical understanding of charged interfaces, with particular interests in contact-electro-catalysis, microdroplet chemistry, and Pd-based electrocatalysis. He has published over 90 peer-reviewed papers, which have received more than 26,000 citations (H-index = 51), including one paper cited over 6,800 times. In the past five years, he has published more than 30 papers as corresponding author in leading journals such as PNAS, JACS, Angew. Chem. Int. Ed., and Nat. Commun. He was selected as an Emerging Investigator by the Royal Society of Chemistry journals Journal of Materials Chemistry A (2021) and Nanoscale (2022), and was named to the Elsevier Highly Cited Chinese Researchers list (2024-2025).

Title: Energy-Coupled Catalysis at Emerging Charged Interfaces

Abstract: Charged interfaces play a crucial synergistic role in charge transfer and chemical reactions, offering significant opportunities in the field of catalysis. This work focuses on three types of dynamic charged interfaces, solid – liquid contact electrification interfaces, liquid – gas microdroplet interfaces, and piezoelectric interfacial structures, and systematically investigates their potential applications in catalytic reactions. Particular attention is given to understanding how interfacial charge transfer influences reaction kinetics and product selectivity. Guided by the concept of mechanically driven charge generation to mediate chemical transformations, we employ contact electrification to achieve the green synthesis of hydrogen peroxide and the partial oxidation of methane under ambient conditions. By regulating the interfacial behavior of charged microdroplets, the selectivity of CO2 conversion is significantly enhanced, and preliminary nitrogen conversion is realized without the need for external catalysts. In addition,

through the design of tailored piezoelectric interface structures, efficient conversion of small gas molecules such as CO2 and CH4 is achieved. These results provide new insights into catalytic reactions mediated by charged interfaces, highlighting their potential for energy conversion and environmentally benign chemical processes.

Invited Speaker

10:50-11:10

Yanchao Mao

Zhengzhou University

Bio: Dr. Yanchao Mao is a professor and principle investigator in School of Physic in Zhengzhou University. He received his PhD in Physical Chemistry from Sun Yat-Sen University in 2014. He was a visiting scholar in the Department of Materials Science and Engineering at University of Wisconsin – Madison under the supervision of Prof. Xudong Wang from 2012 to 2014. His research interests include human-machine interacting sensors and bioelectronics. He has published more than 60 papers in peer reviewed scientific journals including Nature Commun., Adv. Funct. Mater., ACS Nano, etc. His present H-index is 43. His research works were highlighted by ScienceDaily, Phys.org, Materials Today, IEEE Spectrum, NASA Tech Briefs, etc.

Title: Flexible Human-Machine Interacting Sensors

Abstract: Human-machine interface (HMI) sensor is a technology to transfer and exchange information between human and machine, which has aroused lots of attention recently. We developed a series of flexible HMI sensors. By utilizing the charges naturally carried on the human body, a flexible touch-free HMI screen sensor is developed for recognizing diverse gestures in a noncontact operating mode. An intelligent noncontact screen control system is further developed, which is used to unlock the smartphone interface by the noncontact operating mode. A protein-based bioprotonic hydrogel (PBH) with reliable water retention ability was developed for self-powered artificial skins. The PBH can act as a bioprotonic skin (B-skin) for collecting electrophysiological signals acquire high-quality electrophysiological signals. Compared with present artificial skins, this B-skin is all made out of biological materials.Such a B-skin may enable the development of next-generation human-machine merging interfaces.

Invited Speaker

11:10-11:30

Yuan Ma

The Hong Kong Polytechnic University

Bio: Prof. Yuan Ma received his bachelor’ s and M.S. degrees in mechanical engineering and materials science from Tsinghua University, Beijing in 2011 and 2013, respectively. He received his Ph.D. degree in mechanical engineering from the University of California, Berkeley in 2018. He is currently an Assistant Professor at the Hong Kong Polytechnic University. His research interest includes micro/nano scale mechanical and tribological behavior of human-machine interfaces, haptics metamaterials development, wearable

devices with piezoelectret materials, and application of artificial intelligence in human-machine interactions. He has authored more tha 40 peer-reviewed journal papers in Science Robotics, Nature Reviews Electrical Engineering, Nature Communications, Science Advances, Advanced Materials, etc.

Title: Sensation by Design: Tailoring Friction for Next-Gen Human-Machine Synergy

Abstract: Over the last several decades, human-machine interactions have been limited to vision and audio channels. The introduction of haptics technologies has enabled users to receive mechanical feedbacks in the form of virtual touch. While the rapidly advancing haptics technologies in wearable devices and surface haptic devices have enabled many exciting applications in virtual reality (VR), augmented reality (AR), telecommunication, and teleoperation, they still suffer from issues in bulkiness, comfortability, and consistency. The solutions to these issues lie in the fundamental understanding of the multi-physics interactions in the human-machine interface, which include contact deformation, capillary formation, electric field, heat transfer, material non-linearity, and their complicated coupling effects. In this talk, Prof. Ma will discuss models on the multi-physics interactions in human-machine interface, with a special emphasis on modeling the finger friction variation on textured surfaces to design tactile sensations. This talk will also include how the multi-physics models have been applied in developing new wearable sensors, actuators, and surface haptics devices. The discussed models lay the foundation to develop haptics artificial materials (metamaterials) that can deliver any desired haptics performances for the next generation of human-machine mechanical interfaces and Metaverse.

Invited Speaker

11:30-11:50

Wei Tang

Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences

Bio: Prof. Wei Tang, earned both his B.Sc. and Ph.D. degrees from Peking University. His research is primarily centered on interfacial functional electronics. He has authored more than 100 peer-reviewed papers in prestigious journals including Nature Sensors, Nature Energy, Nature Communications, Advanced Materials, JACS, and Angewandte, which have collectively garnered over 18,000 citations and yielded an H-index of 75. He was selected for the National High-level Talent Special Support Program and became a member of the Youth Innovation Promotion Association of the Chinese Academy of Sciences. His work has been further recognized through inclusion in the Elsevier World's Top 2% Scientists list based on annual impact.

Title: Interfacial Electron Transfer and Its Catalytic Mechanisms

Abstract: Charged solid-liquid interfaces are ubiquitous, commonly found in heterogeneous catalysis at the catalyst-solution interface, electrochemical energy systems at the electrode-electrolyte interface, and are of great significance for catalysis science, the energy and chemical industries, among others. In fact, when a solid and a liquid come into contact, spontaneous contact electrification (also known as

triboelectrification) occurs at the interface, leading to electron transfer and the formation of a charged interface, referred to as the contact-electrified solid-liquid interface. The application of mechanical force at this interface can induce electron transfer between the solid and liquid phases, potentially accompanied by corresponding chemical reactions. This report will analyze the electron transfer and catalytic mechanisms at the contact-electrified solid-liquid interface. Furthermore, it will explore this novel catalytic method — contact-electro-catalysis — from the perspectives of materials, excitation methods, and fundamental applied research.

Technical Sessions

D4-AM-B10: 3D Printing and Bioprinting

10:30-12:10, April 20, 2026 **Convention Hall A**

Session Chair: Zeyu Luo, West China Hospital, Sichuan University

Invited Speaker

10:30-10:50

Changhong Cao

McGill University

Bio: Dr. Cao is a tenured professor and Canada Research Chair (Tier 2) in small-scale materials and manufacturing, in the Department of Mechanical Engineering at McGill University. He earned his Ph.D. in Mechanical Engineering from the University of Toronto and was a postdoctoral fellow at MIT before joining McGill. His research interests include N/MEMS, transfer printing technologies, experimental nanomechanics of advanced structures, and the development of new additive manufacturing mechanisms. As the lead author, his research has been published in journals, including Science Advances, Advanced Materials, Advanced Functional Materials, and ACS Nano. He has also been recognized with the Young Leaders Award and Young Leaders International Award from TMS, the Young Scientist Award from Springer Nature Microsystem and Nanoengineering, and Stony Brook University 40 under 40.

Title: Micro DIW 3D Printing and Necroprinting

Abstract: This talk presents two complementary platforms addressing persistent challenges in DIW 3D printing. 3D Necroprinting explores the use of biological structures—mosquito proboscises—as functional printing nozzles. The proboscis achieves ~20 micrometer printing resolution, approaching capabilities typically reserved for expensive specialized equipment. We characterize its mechanical performance, establish operational guidelines, and demonstrate feasibility for bioprinting applications with encouraging cell viability results. Binder Spraying Additive Manufacturing (BSAM) enables support-free printing of complex geometries through rapid interfacial polymerization. By combining controlled gelation with instantaneous in-situ polymer formation, we fabricate freestanding structures—overhangs, internal voids, and intricate lattices—without auxiliary supports. The platform accommodates diverse materials: organic, ceramic, and metal nanocomposites with tunable mechanical properties. Together, these approaches demonstrate how mechanics-informed design and chemistry can address practical manufacturing limitations.

Invited Speaker

10:50-11:10

Xinwei Wei

Zhejiang University

Bio: Dr. Xinwei Wei, a PI and Assistant Professor at the School of Pharmacy/Jinhua Institute of Zhejiang University. He has led and participated in over a dozen scientific research projects funded by the Ministry of Science and Technology and the National Natural Science Foundation of China. His main research areas include intelligent biomimetic devices, biosensing detection, and intelligent drug delivery systems. As the first or corresponding author, he has published over 30 SCI papers in high-impact international journals such as Nature, Nat. Biomed. Eng., Nat. Rev. Electr. Eng., Matter, ACS Nano, Biosens. Bioelectron. He has also obtained over 10 national invention patents and participated in the compilation of textbooks and academic monographs such as《Biomedical Sensing Technology》,《Biomimetic Sensing and Intelligent Perception》, and《Advanced Drug Delivery Systems》. He serves as the young academic editor of Bio-Design and Manufacturing, the guest editor of Sensors and Frontiers in Bioengineering and Biotechnology, and is a young editorial board member of journals such as BME Frontiers and Bio integration.

Title: Voice-controlled Capsule: A Biomimetic Auditory Device Based on 3D-Printed Artificial Cilia and Its Biomedical Applications

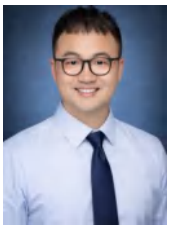
Abstract: During the auditory perception process in mammals, the hair cells of the cochlea resonate in response to external sound wave signals. Through their highly specialized cilia bundles, the sound wave vibrations are converted into neural excitation signals. Inspired by this, we developed a micro-scale biomimetic auditory device based on an artificial cilia array using high-precision 3D printing technology. This device can directly respond and recognize audible frequency sound wave signals, including piano music and speech signals, without relying on electricity or algorithms. This cilia-based biomimetic device can also generate vibrations in water upon external sound excitation, which can be used in various biomedical applications. For example, by loading insulin and glucagon onto different length/diameter ratios of cilia, we constructed a capsule-shaped resonance-responsive drug delivery device. By applying different frequencies of acoustic stimulation, it can selectively trigger the release of insulin or glucagon, thereby achieving bidirectional glucose regulation functions. Additionally, this biomimetic device can serve as a non-invasive acoustic tool, converting low-frequency acoustic energy into local fluid shear force. It can selectively activate mechanosensitive ion channels on the cell membrane, thereby triggering intercellular calcium waves and being used to regulate calcium ion-related cell behaviors, such as the contraction rhythm of cardiomyocytes and insulin secretion of pancreatic β cells. The cilia-based biomimetic auditory device has broad application potential and can be used for more personalized tasks in the future, including integration with brain-computer interfaces and electronic drugs.

Invited Speaker

11:10-11:30

Zeyu Luo

West China Hospital, Sichuan University



Bio: Zeyu Luo is an Associate Professorn the Department of Orthopaedics at West China Hospital, Sichuan University. He holds M.D. and postdoctoral qualifications and is a joint doctoral graduate of Harvard Medical School. He has led several competitive research programs, including the National Postdoctoral Innovative Talents Support Program, the Sichuan Tianfu Qingcheng Plan, and the Sichuan Postdoctoral Innovative Talents Support Program. He is also the principal investigator of one project funded by the National Natural Science Foundation of China.

To date, he has published 71 SCI-indexed papers in leading journals such as *The Lancet*, *Nature Metabolism*, *Nature Communications*, *Advanced Materials*, *PNAS*, and *Advanced Functional Materials*. His publications have been cited more than 1,600 times in total, and two of his papers have been recognized as ESI Top 1% Highly Cited Papers globally.

Title: Complex Tissue Interface Regeneration through 3D Bioprinting and Microfluidic Technologies

Abstract: Complex tissue interfaces, such as tendon-to-bone, cartilage-to-bone, and osteochondral interfaces, are characterized by hierarchical architectures, gradient compositions, and tightly coordinated biological functions. The regeneration of these interfaces remains a major challenge in regenerative medicine, as conventional therapeutic strategies often fail to recapitulate their structural and functional complexity. In recent years, 3D bioprinting and microfluidic technologies have emerged as powerful tools for addressing this challenge.

3D bioprinting enables the precise spatial deposition of cells, biomaterials, and bioactive factors, making it possible to fabricate biomimetic constructs with controlled geometry, anisotropic organization, and compositional gradients. Meanwhile, microfluidic systems provide dynamic control over the cellular microenvironment, including nutrient transport, biochemical gradients, mechanical stimulation, and vascular-like perfusion. The integration of these two technologies offers a promising strategy for reconstructing complex tissue interfaces by combining structural fidelity with microenvironmental regulation.

This approach not only facilitates the fabrication of multi-scale, heterogeneous tissue constructs, but also provides a versatile platform for investigating cell – material interactions, interface development, and regenerative mechanisms. Furthermore, the synergy between 3D bioprinting and microfluidics may accelerate the translation of engineered interface tissues toward personalized regenerative therapies and disease modeling. Overall, the convergence of 3D bioprinting and microfluidic technologies represents a transformative direction for advancing the regeneration of complex tissue interfaces.

Invited Speaker

11:30-11:50

Guoliang Ying

Sichuan University

Bio: Guoliang Ying, Associate Professor and PhD Supervisor, is recognized as a Young Talent of the Sichuan Tianfu Emei Program, an Overseas Distinguished Talent of Sichuan Province, an expert of the Chengdu Tianfu Haizhi Program, and a member of the A Program of the "Double Ten Talent" Initiative at the West China School of Basic Medical Sciences and Forensic Medicine, Sichuan University. He completed postdoctoral training at Harvard Medical School, University of Antwerp, and Imperial College London, and has published over 30 research articles in high-impact journals, including PNAS、Adv. Mater.、Adv. Funct. Mater.、ACS Nano、Matter, with 5 papers in journals with an impact factor above 10, 5 cover papers, 1 ESI highly cited paper, and 1 hot paper. He serves as a member of the POCT Committee of the Chinese Association for Analytical Testing, a member of the Expert Database of the Chengdu Municipal Bureau of Industry and Information Technology, a senior member of the Chinese Society of Biomedical Engineering, and a senior member of the Chinese Society for Micro-Nano Technology, and is a topical editor/guest editor for Micromachines as well as a reviewer for internationally authoritative journals including Advanced Materials, Advanced Functional Materials, and Biomaterials. He has led multiple research projects, including the NSFC General Program, Sichuan Province General Program, and Sichuan Tianfu Emei Program projects.

Title: Mesenchymal Stem Cell–Laden Porous Injectable Bioprinted Hydrogel for Glottic Insufficiency

Abstract: Glottic insufficiency (GI) secondary to unilateral vocal fold paralysis (UVFP) compromises phonation and swallowing, diminishes quality of life, and in severe cases can result in fatal airway obstruction. Injection laryngoplasty using autologous adipose tissue or biocompatible fillers remains a mainstay of treatment. However, its long-term efficacy is frequently compromised by postoperative inflammation, material migration, and limited durability, restricting sustained functional restoration.

Three-dimensional (3D) bioprinting is an advanced precision manufacturing technology that enables the fabrication of patient-specific constructs matching the morphology of vocal fold defects. In our previous work, we developed a GelMA/PEO aqueous two-phase bioink that enables the direct printing of cell-laden porous hydrogel constructs. This phase-separation–based strategy allows controllable pore formation while maintaining structural integrity, thereby facilitating efficient mass transport and high cell viability.

In the recent study, we engineered an injectable hierarchically porous hydrogel construct encapsulating human adipose-derived mesenchymal stem cells (hADSCs) to promote glottic adipose tissue regeneration and restore vibratory function. By precisely tuning material composition and printing parameters, the resulting hydrogels exhibit well-defined, interconnected hierarchical porosity. Their mechanical properties closely approximate those of native glottic tissue, with favorable biocompatibility and viscoelastic behavior that recapitulates physiological characteristics. Importantly, the constructs maintain structural stability during and after in situ injection.

In rabbit and canine models, the constructs gradually degrade as encapsulated hADSCs proliferate and

differentiate into vocal fold adipocytes, promoting reconstruction of the glottic adipose layer. This coordinated process restores glottic structure and vibratory symmetry, enhances mucosal wave propagation, and improves phonatory function. Histology confirms organized collagen deposition and effective tissue remodeling. Together, the injectable platform combines patient-specific bioprinting, mechanical compatibility, and cell-mediated regeneration, providing a translationally viable approach for durable anatomical and functional recovery of GI.

Invited Speaker

11:50-12:10

Nan Jiang

Sichuan University

Bio: Nan Jiang, a Professor and Doctoral Supervisor, holds the titles of National Outstanding Young Talent (Overseas High-level), Distinguished Young Talent in Science and Technology of Sichuan Province, and Fellow of the International Association of Advanced Materials (IAAM). She is a member of Sichuan University's "Double Hundred Talents Program" and has engaged in research and visiting work at Harvard University, Imperial College London, and Stanford University. Currently, she works at Sichuan University's West China School of Basic Medical Sciences and Forensic Medicine, serving as a member of the College's Professor Committee, Sub-Committee of the Academic Degree Evaluation Committee, and director of the "Bioprinting and Medical Sensing" Laboratory. She also holds positions in several academic societies, including related branch members of micro-nano technology, biomaterials and biomedical engineering. She has published 79 high-level academic papers, including 47 first or corresponding author papers in top international journals such as PNAS, Matter, Adv. Mater. (2 papers), Mater. Today, Adv. Funct. Mater. and Biosens. Bioelectron. Among them, 24 papers have an impact factor greater than 10, including 5 journal cover papers, 1 ESI Highly Cited Paper and 1 ESI Hot Paper, with a total of more than 5,400 citations and an H-index of 40. She has applied for 15 invention patents, including 9 authorized Chinese invention patents, 1 authorized US invention patent and 3 utility model patents, with 1 technological achievement transfer and 1 participated industry standard. Her scientific and technological achievements have incubated 2 technology-based enterprises and been reported by mainstream media such as Guangming Daily, CNN (USA) and BBC (UK). She has won honors including the "Honorable Mentions" Award at ISWC, the "Young Scientist Medal" of IAAM and the "Excellence in Innovation" Award of Harvard Medical School, and has presided over or mainly participated in more than 10 national and provincial research projects.

Title: Hofmeister Effect-Mediated Room-Temperature Direct Ink Writing 3D Printing and Sensing Research of F127DA

Abstract: 3D printing and medical sensing represent promising directions in biomedical engineering. Here we present our recent advances: We integrated fluorescence oxygen sensing with organ-on-a-chip,

fabricating flexible PtOEP-doped PDMS membranes for in-situ dissolved oxygen detection (Proc. Natl. Acad. Sci. 2024).For 3D printing, we developed aqueous two-phase GelMA/PEO inks to one-step prepare porous microspheres (Adv. Mater., 2018), and realized in-situ GelMA printing via a handheld 3D printer (Mater. Today Bio, 2018).

We have also explored the 3D printing applications of other materials beyond GelMA. Pluronic F127 dimethacrylate (F127DA) exhibits considerable potential for biomedical applications owing to its excellent biocompatibility, favorable mechanical toughness, high transparency, and thermosensitive behavior. 3D printing is pivotal for F127DA ' s practical application by enabling on-demand customized sensor fabrication, compared to digital light processing (DLP) printing, direct ink writing (DIW) offers more advantages over including simplified equipment, reduced manufacturing cost. However, DIW requires inks with high viscosity, F127DA can only form high- viscosity physical gels at elevated temperatures, and such stringent conditions severely restrict its practical applications.

Leveraging the Hofmeister effect, lithium chloride (LiCl) was introduced to weaken hydrogen bonding between polyethylene oxide (PEO) segments of F127DA molecular chains and water molecules, thereby reducing the hydration shell thickness and lowering the gelation temperature of 20 wt% F127DA from 30° C to 22° C. This modification enabled stable, high-precision room-temperature DIW while effectively preserving the intrinsic rheological properties of the ink.

The 3D-printed F127DA structures were employed for constructing photochemical and electrochemical sensors, which exhibited excellent detection linearity and high sensitivity benefiting from F127DA ' s optical transparency and LiCl-enhanced ionic conductivity. A portable handheld 3D printer was independently developed for lightweight, in-situ fabrication. This work establishes a low-cost, customizable technical route for F127DA-based hydrogel sensors.

Technical Sessions

D4-AM-B11: Functional Nanomaterials and Synthesis & Micro/Nano/Molecular Fabrication

10:30-11:30, April 20, 2026 **Convention Hall F**

Session Chair: Nimer Murshid, Carnegie Mellon University in Qatar

10:30-10:45	**Paper ID:** Oral# 18 **Paper Title:** Tunable Electrodeposition of Porous Cu-Ni Nanostructure Arrays (0D to 2D) for High-Performance Lithium-Ion Battery Anodes **Presenter:** Esayas Berhanu Kefene, Sichuan University
10:45-11:00	**Paper ID:** Oral# 229 **Paper Title:** Synergistic Contact-Electro-Catalysis and Photocatalysis Nitrogen Fixation on Au doped Fluorinated Nu-1000 **Presenter:** Shuai Ma, Beijing Institute of Nanoenergy and Nanosystems，Chinese Academy of Sciences
11:00-11:15	**Paper ID:** Oral# 287 **Paper Title:** Optimization of Cu2ZnSnS4 (CZTS) Thin Films Using PDMS Polymer Doping: Structural, Optical, and Photovoltaic Performance Analysis **Presenter:** Yahya Alajlani, Jazan University
11:15-11:30	**Paper ID:** Oral# 412 **Paper Title:** Moiré Superlattices Enable Ultrasensitive Wearable Monitoring of Parkinson's Disease **Presenter:** Ning Sun, Peking University

Technical Sessions

D4-AM-B12: Micro/Nanofabrication Techniques and Devices

10:30-11:30, April 20, 2026 **Convention Hall C**

Session Chair: Xia Liu, Beijing Institute of Technology

Invited Speaker

10:30-10:50 **Shuangshuang Zeng**

Huazhong University of Science and Technology

Bio: Shuangshuang Zeng is currently professor in the School of Integrated Circuits at Huazhong University of Science and Technology, China. He obtained his bachelor degree in material physics from University of Science and Technology of China in 2015 and PhD degree in microelectronics from Uppsala University, Sweden in 2020. From 2020 to 2023, he conducted postdoctoral research at Uppsala University, Sweden and ETH Zurich, Switzerland. In June 2023, he joined Huazhong University of Science and Technology as a faculty member. His research focuses on the development novel micro/nano fabrication techniques, with applications in biosensing and optoelectronic devices.

Title: Nanopore Stencil Lithography: Advances and Perspectives

Abstract: Nanoscale patterning is essential for advanced microelectronic, photonic, and biosensing devices, where precise control of geometry and materials governs performance. Nanopore stencil lithography (NSL) is a resist-free nanopatterning technique that enables direct, high-resolution patterning of diverse materials with intrinsic self-alignment. This talk introduces the working principles of NSL and demonstrates deterministic nanostructure formation via material deposition through nanoscale apertures. Recent examples, including complex nanostructures and sub-100 nm organic light-emitting diode (OLED) arrays, highlight NSL as a scalable and versatile nanofabrication platform for a broad range of emerging nanoscale devices and integrated systems.

Invited Speaker

10:50-11:10 **Junrui Zhang**

Chongqing University of Technology

Bio: Junrui Zhang, is currently a Professor at Chongqing University of Technology (CQUT), serving as Director of the Chongqing Engineering Research Center for Intelligent Minimal & Non-invasive Medical Devices, CQUT Brain Computer Interfaces R&D Center. He received his Ph.D degree from the École Polytechnique Fédérale de Lausanne (EPFL) from Switzerland in 2019. Prof. Zhang developed a 3D-EMG-ISFET biosensor process that eliminates the traditional compromise between high performance and wafer-level

reproducibility. The technology was licensed to a Swiss high-tech firm and helped secure CHF 10.5 million in funding, with Mayo Clinic among the investors. In 2021, he co-founded an innovative medical device company as Chief Technology Officer, securing over 100 million RMB in funding.

Prof. Zhang's current research interest is in designing soft electronic materials that match biological tissue in mechanics, electrics, and chemistry, creating conformal sensors and flexible semiconductors for continuous clinical monitoring. His goal is to make minimally invasive human-machine interfaces routine.

Title: Applications of Flexible Electronics in Biosensing

Abstract: Biosensing and flexible microsystems are reshaping paradigms in health monitoring and human-machine interaction. This report focuses on two cutting-edge technologies: 1. Wearable electrochemical sensors enable dynamic monitoring of chemical biomarkers in body fluids. Data is wirelessly transmitted to intelligent terminals, where multi-biomarker fusion algorithms establish health baselines. This technology is applied to diabetes early warning, exercise evaluation, and cardiovascular disease screening, advancing precision health management toward continuous monitoring. 2. Flexible, stretchable electrode arrays feature skin-like elastic modulus designs that conformally attach to the body for 24-hour wireless acquisition of EEG, ECG, and EMG signals. Innovatively integrated micro-thermal control and electrical stimulation modules provide closed-loop feedback interventions for neck myofascial tissues, alleviating muscle fatigue and offering portable solutions for rehabilitation medicine. Both technologies possess mass-manufacturing potential and demonstrate broad industrial prospects in smart healthcare, sports wellness, and human-machine interaction domains.

Invited Speaker

11:10-11:30

Jicong Zhao

Nantong University

Bio: Jicong Zhao is currently a Professor and Ph.D. supervisor at Nantong University (NTU). He received the Ph.D. degree from the Institute of Semiconductors, Chinese Academy of Sciences, in 2017. From 2019 to 2020, he conducted visiting research at the National University of Singapore. He received Excellent Young Scientists Fund of Jiangsu Province (2025) and undertook 19 research projects, including General Program and Key Program of the National Natural Science Foundation of China (NSFC), Jiangsu Provincial Major Science and Technology Program, Key Project of the Basic Strengthening Program and enterprise-sponsored technology development projects.

Prof. Zhao has published more than 30 peer-reviewed papers (IEEE Transactions on Microwave Theory and Techniques, IEEE Transactions on Electron Devices, etc.), and authorized 10 Chinese invention patents. He has delivered more than 10 invited talks at major academic conferences (UFFC-JS, NSITC, CSCAS, etc.). He served as a co-organizer of the RF Filter Innovation Technology Conference 2025, a session chair of the Circuits and Systems Conference 2025. He also serves as an Associate Editor and Editorial Board

Member of Microelectronics Journal, and as a Youth Editorial Board Member of the Chinese Journal of Sensors and Actuators. His research field covers micro/nano electronic science and technology, with a particular focus on RF acoustic resonator and MEMS infrared filter chips.

Title: Electrostatically Actuated MEMS Fabry – Pérot Tunable Filter for LWIR Imaging and Sensing

Abstract: The long-wave infrared (LWIR) band is an important atmospheric window with strong target thermal radiation and rich background information, making it valuable for resource exploration, environmental monitoring, and infrared imaging. Conventional spectral dispersion technologies, such as gratings, Fourier spectrometers, and prisms, generally suffer from large size, complex structures, and poor integrability. MEMS Fabry-Pérot tunable filters (MEMS-FPTFs) based on multi-beam interference provide a compact solution for chip-scale, narrowband, high-resolution, and wide range spectral scanning in the LWIR region. We developed an electrostatically actuated MEMS-FPTF for LWIR. An optoelectronic co-optimization strategy was employed to effectively improve both the spectral resolution and the tuning range. The device achieved continuous tunable filtering over 10.3-12 μm, with a minimum full width at half maximum (FWHM) of 188 nm and a maximum quality factor (Q) of 63.7. This device shows strong potential for high-performance LWIR spectral filtering in remote sensing, autonomous perception, and spectral detection.

Technical Sessions

D4-PM-A01: Micro Biosensing and Micro Manipulation

13:30-15:20, April 20, 2026 **Meeting Room 301A**

Session Chair: Megan Yi-Ping Ho, The Chinese University of Hong Kong

Keynote Speaker

13:30-14:00

Megan Yi-Ping Ho

The Chinese University of Hong Kong

Bio: Yi-Ping (Megan) Ho is currently a Professor, the Vice Chairman (Research) and the MSc Program Director in the Department of Biomedical Engineering at The Chinese University of Hong Kong. She received her B.S. and M.S. in Power Mechanical Engineering from National Tsing-Hua University, Taiwan. She received her Ph.D. in Mechanical Engineering from the Johns Hopkins University. After her postdoctoral training at the Department of Biomedical Engineering in Duke University, she received the Young Elite Researcher Award from the Danish Research Council and started her independent career in the Interdisciplinary Nanoscience Centre and the Department of Molecular Biology and Genetics at Aarhus University in Denmark. She has published 92 peer-reviewed journal articles, 7 book chapters, 92 conference papers, edited 1 book and holds 7 granted patents. The results that she presented have been recognized internationally by the American Society of Gene Therapy and Controlled Release Society. Her research is focused on developing nanosensors and microfluidics as diagnostic tools to expand the capacity of disease detection and treatment evaluation.

Title: Deformability Cytometry for Noninvasive High-Throughput Characterization of Cells

Abstract: Cell mechanical properties, governed by the intrinsic cell structures, are closely related to cellular functions, such as cell motility, division and apoptosis. Over the past decades, increasing evidence has gathered that cellular mechanical properties may serve as biomarkers to reveal the cellular status for clinical diagnostics. The microfluidic-based deformability cytometry is emerging as a technique for high throughput mechanical properties assessment. This presentation will highlight our recent advancement on a framework developed to improve the robustness of the so-called real-time deformability cytometry (RT-DC) - a computational parameter, termed the ring width (RW), innovatively derived from the intensity gradient at cellular boundaries. We demonstrate that the RW-modulated imaging significantly improves both the measurement reproducibility and sensitivity, especially relevant enabling discrimination of subtle variations between similar cell populations. This presentation will also discuss the development of quantitative phase deformability cytometry (QPDC), combining the off-axis quantitative phase imaging with a microfluidic chip, to image the quantitative phase shift (Φ) of cells. Using mouse muscle myoblast C2C12 as a model cell line, QPDC is demonstrated with an improved signal-to-noise ratio, especially for

the measurement of altered deformability when cells are subjected to actin depolymerization. Furthermore, the phase value extracted by QPDC may provide an additional measure of cellular biophysical properties.

Invited Speaker

14:00-14:20

Xiaobao Cao

Guangzhou National Laboratory

Bio: Dr. Xiaobao Cao has long been dedicated to research at the intersection of medicine and engineering, focusing on microfluidics and bio-intelligent manufacturing technologies. He continuously pursues innovative development in areas such as microfluidics, single-cell multi-omics analysis, and life science automation. To date, he has published over 50 papers in high-impact journals including Advanced Materials and Science Advances, and holds more than 40 authorized patents. With extensive experience in technology transfer and industrialization, Dr. Cao has independently developed over 10 innovative tool systems to address key needs in the life sciences. Leveraging his core patented technologies, he founded Lead Healthcare, which completed its angel round and Pre-A round financing in 2025.

Title: Unlocking Cellular Heterogeneity: High-Content Analysis with Microfluidics

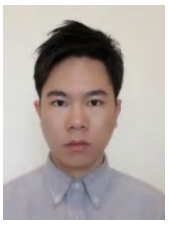
Abstract: Cellular heterogeneity plays a critical role in complex biological processes, including development, disease progression, and therapeutic response. However, comprehensively characterizing this heterogeneity requires technologies capable of high-resolution, multi-parametric analysis at the single-cell level. Here, we present an active microfluidic platform designed for high-content analysis to decode this complexity. Our system integrates advanced functionalities for three key applications: (1) high-throughput single-cell sequencing, enabling unbiased transcriptional profiling of thousands of individual cells; (2) controlled co-culture and analysis of dynamic cell-cell interactions within a defined microenvironment; and (3) multi-omic co-profiling that simultaneously captures the transcriptome and proteome from the same single cell. By leveraging active microfluidic control for precise manipulation, isolation, and processing, this platform overcomes limitations of conventional techniques, providing a more integrated view of cellular states and intercellular communication. This approach offers a powerful tool for systems biology and holds significant promise for advancing precision medicine by revealing the subtle, yet crucial, differences that define cellular function and dysfunction.

Invited Speaker

14:20-14:40

Guangyao Cheng

The Chinese University of Hong Kong



Bio: Dr. Guangyao CHENG earned his Ph.D. in Biomedical Engineering from The Chinese University of Hong Kong in 2022 and his B.E. from Sun Yat-Sen University in 2018. His research focuses on developing active and precise microfluidic systems to address challenges in high-throughput droplet manipulation and deformability cytometry, enabling advanced applications in single-cell multi-omics and point-of-care diagnostics. He has published journal articles in high-impact venues such as Advanced Materials, Chemical Society Reviews, Small, Microsystems & Nanoengineering, and ACS Applied Materials & Interfaces. Dr. CHENG was also honored with the CBMS Young Researcher Award at the 25th μTAS conference.

Title: Active Photo-Responsive Fluorosurfactants for Precise Light-Driven Droplet Manipulation

Abstract: Droplet microfluidics has emerged as a powerful paradigm for high-throughput experimentation, enabling the compartmentalization of reactions for single-cell analysis, enzyme screening, and molecular diagnostics. Central to the utility of these systems is the ability to precisely manipulate individual droplets; however, conventional methods such as electrowetting or mechanical valving often require complex, pre-defined hardware and rigid chip architectures. Light-driven manipulation offers a compelling, contactless alternative, providing the flexibility to perform spatiotemporally controlled operations without integrated electrodes.

In this work, we propose a novel “active” photo-responsive fluorosurfactant enabled by gold-silica core-shell (f-Au@SiO2) plasmonic nanoparticles. Unlike traditional surfactants that serve only as passive stabilizers, this functionalized interface acts as a light-responsive engine. By utilizing localized photothermal effects at the droplet boundary, we demonstrate the ability to drive precise droplet movement and programmable merging on-demand.

We further extend this light-induced mobility to a "trap-and-release" application for selective sample recovery. While trapping allows for the continuous observation of biological reactions in droplets, the ability to selectively retrieve a specific "hit" droplet remains a significant challenge. By leveraging the light-driven droplet moving capability, we can selectively "drive" a target droplet out of its stationary trap on demand. Overall, by transforming the fluorosurfactant from a passive stabilizer into a light-controlled actuator, this research establishes a new paradigm for reconfigurable “smart” microfluidic platforms capable of autonomous and complex biochemical workflows.

Invited Speaker

14:40-15:00

Zida Li

Shenzhen University

Bio: Zida Li is a tenured Associate Professor and PI at Shenzhen University. He received his B.S. degree from the University of Science and Technology of China in 2012, completed short-term research training at the University of Hong Kong, and earned his Ph.D. from the University of Michigan in 2018. Since 2018, he has been with the College of Biomedical Engineering at Shenzhen University and was promoted to tenured Associate Professor in 2024. His interdisciplinary research spans microfluidics, molecular biology, and artificial intelligence, with a focus on single-molecule nucleic-acid and immunoassays, as well as single-cell sequencing. His work has been published in journals including PNAS, Advanced Science, and Analytical Chemistry, and has been supported by the National Natural Science Foundation of China, the Natural Science Foundation of Guangdong Province, and Shenzhen medical research funding programs.

Title: Label-Free Digital Nucleic Acid Tests via Precipitation Readout and Deep-Learning–Assisted Bright-Field Imaging

Abstract: Molecular diagnostics is foundational to precision medicine; however, digital PCR—despite its high analytical sensitivity—often requires fluorescent probes and dedicated optical instrumentation, limiting cost-effectiveness and portability. Here we present a precipitation-readout, label-free strategy for digital nucleic-acid quantification. The approach exploits magnesium pyrophosphate precipitates generated during loop-mediated isothermal amplification (LAMP) as a quantitative surrogate for fluorescence and couples bright-field microscopy with deep-learning–based image analysis to enable digital, low-cost, and multiplex detection. We first establish Deep-dLAMP, which performs absolute quantification in polydisperse emulsions by simultaneously inferring droplet volume and precipitation states from bright-field images. We then introduce StratoLAMP, in which primer designs with distinct concentrations induce target-specific, stratified precipitation signatures, enabling multiplex readout without labeling. Finally, StratoLAMP-2 removes microfluidic hardware by generating polydisperse droplets via vortex emulsification and applies a YOLOv11-based detection and tracking pipeline to achieve accurate multiplex digital quantification in more complex, practical workflows. Overall, this precipitation-centric framework eliminates dyes and specialized detection modules while retaining digital quantification capability. By relying solely on bright-field imaging and computational interpretation, it provides a scalable route toward multiplex, high-sensitivity nucleic-acid testing for molecular diagnostics and pathogen screening, particularly in resource-limited settings.

Invited Speaker

15:00-15:20

Hon Fai Chan

The Chinese University of Hong Kong

Bio: Prof. Hon Fai Chan is an Associate Professor at the School of Biomedical Sciences and the Institute for Tissue Engineering and Regenerative Medicine at the Chinese University of Hong Kong. He received his Bachelor degree from the University of Hong Kong, before pursuing his Ph.D. degree at Duke University with the support of the Sir Edward Youde Memorial Fellowships for Overseas Studies. During 2015-2017, he worked as a post-doctoral researcher at Columbia University and Massachusetts Institute of Technology before joining CUHK in 2018. Prof. Chan's research mainly focuses on advancing biofabrication approach and biomaterial design for stem cell tissue engineering and regenerative medicine, as well as understanding how microenvironmental cues influence stem cell proliferation and differentiation. Prof. Chan has published over 70 research articles in journals such as PNAS, Science Advances, Advanced Materials, Advanced Science, Biomaterials, and Biofabrication.

Title: Microfluidic Encapsulation Strategies for Tissue Engineering and Regenerative Medicine

Abstract: Recent advances in microfluidic technologies have offered unprecedented precision in fabricating microcarriers for cell and drug encapsulation. This presentation will explore the application of microfluidic encapsulation strategies to address critical challenges in tissue engineering and regenerative medicine. First, we will present microsphere-based strategies for delivering bioactive glass as a therapeutic agent for treating soft tissue injuries such as diabetic wound and inflammatory bowel disease. Second, we will introduce the approach of using hydrogel microsphere for encapsulating human pluripotent stem cells that supports high-efficiency 3D hepatic differentiation and the subsequent formation of functional microtissues. This approach facilitates the co-culture of liver microtissues with endothelial cells to generate complex, vascularized constructs with enhanced maturation and functional integration potential. Collectively, our work demonstrates the versatility of microfluidic encapsulation as a powerful technique for advancing biomedicine. It paves the way for next-generation therapies for organ repair and the treatment of complex chronic diseases.

Technical Sessions

D4-PM-A02: Micro/Nano Electro-Mechanical Systems (M/NEMS)

13:30-15:30, April 20, 2026 **Meeting Room 301B**

Session Chair: Wei-Mong Tsang, Shanghai Institute of Optics and Fine Mechanics, CAS

13:30-13:45	**Paper ID:** Oral# 110 **Paper Title:** Temperature Effect on Self-Oscillation Thresholds in Thermal-Piezoresistive MEMS Resonators **Presenter:** Haojie Li, Northwestern Polytechnical University
13:45-14:00	**Paper ID:** Oral# 135 **Paper Title:** Programmable Optoelectronic Assembly of Semiconductor Nanoparticles via Light-Triggered Surface Charge Modulation **Presenter:** Yanan Mao, Beijing Institute of Technology
14:00-14:15	**Paper ID:** Oral# 204 **Paper Title:** Investigations of Temperature Characteristics of AlN/Sapphire SAW Resonators **Presenter:** Mingxin Li, ShanghaiTech University
14:15-14:30	**Paper ID:** Oral# 269 **Paper Title:** A Time-Division Multiplexing Interface with DC Drift Blocking and Input Isolation for Dual-Mode MEMS Resonant Sensors **Presenter:** Yuchen Wang, National University of Defense Technology
14:30-14:45	**Paper ID:** Oral# 280 **Paper Title:** Design and Analysis of a High-Linearity Piezoresistive Pressure Sensor Based on Silicon – Silicon Bonding **Presenter:** Xun Liu, Aerospace Information Research Institute, University of Chinese Academy of Sciences
14:45-15:00	**Paper ID:** Oral# 284 **Paper Title:** Research and Application of Human-Machine Interaction Interface Based on Hydrogel Flexible Epidermis Dual-Mode Sensor **Presenter:** Hao Wang, Zhejiang University
15:00-15:15	**Paper ID:** Oral# 313 **Paper Title:** Pmuts-Based Ultrasound Proximity Detection for Robot Robotic Tactile Sensing **Presenter:** Daren An, Xi'an Jiaotong University
15:15-15:30	**Paper ID:** Oral# 154 **Paper Title:** Machine Learning-Based Mass and Location Prediction for MEMS Cantilever Sensors Using Modal Frequencies **Presenter:** Mehdi Ghommem, American University of Sharjah

Technical Sessions

D4-PM-A03: Micro Biosensing and Micro Manipulation & Milli Micro and Nano Robotics

13:30-14:50, April 20, 2026 **Meeting Room 301C**

Session Chair: Haisong Lin, Westlake University

Invited Speaker

13:30-13:50 **Na Liu**

Shanghai University

Bio: Professor Na Liu is affiliated with the School of Mechatronic Engineering and Automation, Shanghai University. Her primary research interests focus on micro- to mini-scale robotics for biomedical applications including diagnosis, drug screening, and therapeutic treatment. She has published over 50 high-impact journal papers, with work appearing in Nature Communications, Advanced Science, and the IEEE Transactions series. She holds more than 20 authorized invention patents, some of which have been successfully commercialized for practical applications.

Prof. Liu has led a portfolio of research projects at the national, municipal and provincial levels, supported by NSFC and the Shanghai Science and Technology Commission. Her academic distinctions include the First Prize of the Technological Invention Award (China Instrument and Control Society), the First Prize of the Shanghai Technological Invention Award, and selection for the Shanghai Sailing Talent Program.

Title: Capsule Robotics for Gastrointestinal Diseases Diagnosis and Treatment

Abstract: Capsule robots have emerged as a promising minimally invasive tool for gastrointestinal diseases, with core applications in sample collection and targeted drug release. For sample collection, they enable precise targeted tissue biopsy and mucosal sample acquisition via magnetic navigation, avoiding invasive procedures and improving the accuracy of lesion samples. In terms of targeted drug release, they achieve site-specific drug delivery to lesion areas under remote control, reducing systemic side effects and enhancing therapeutic efficacy. This report introduces our work on capsules for targeted-site sampling and drug delivery at multiple locations.

Invited Speaker

13:50-14:10

Haisong Lin

Westlake University

Bio: Dr. Haisong Lin is currently serving as an assistant professor at the School of Engineering, Westlake University. He earned his B.S. degree in Electrical and Computer Engineering from Iowa State University in 2016, after which he pursued his Ph.D. in Electrical and Computer Engineering at Prof. Sam Emaminejad's Interconnected & Integrated Bioelectronics Laboratory at the University of California, Los Angeles (UCLA) from 2016 to 2021, and continued as a postdoctoral researcher in the same group until 2022. From 2022 to 2024, he served as a research assistant professor in the Department of Mechanical Engineering at the University of Hong Kong and Co-Principal Investigator at Hong Kong Advanced Biomedical Instrumentation Centre. He joined the School of Engineering at Westlake University in June 2024 as an assistant professor, leading the Laboratory for Biochips & Biosensors.

Title: Droplet Robot: Development, Applications, and Perspectives

Abstract: The industrial revolution brought about by automated robots is accelerating our production and daily life while reducing time and labor costs. Similarly, new biochemical experimental robot platforms are expected to bring about a revolution in various fields, such as medical diagnostics, omics research, drug development, and chemical and materials synthesis. In this presentation, the speaker will showcase the liquid droplet robot platform developed by their team. This platform consists of multiple liquid droplet robots working collaboratively to perform fully automated sample processing on a palm-sized platform, including operations such as transportation, separation, classification, and mixing. By integrating with biosensors, biological reagents, and intelligent algorithms, it enables portable and efficient detection of key biomarkers for human diseases.

Invited Speaker

14:10-14:30

Qingkun Liu

Shanghai Jiao Tong University

Bio: Liu Qingkun is currently an Associate Professor at the School of Integrated Circuits, Shanghai Jiao Tong University. He earned his Bachelor’ s degree from the University of Electronic Science and Technology of China and his Ph.D. from Zhejiang University. He has led several national research projects, including the National Key R&D Program and the projects funded by NSF of China. His primary research focuses on micro/nanorobotics, with multiple publications as first or corresponding author in top-tier journals such as Nature, Nature Materials, Science Robotics, etc. He also serves as an editorial board member for journals including Cyborg and Bionic Systems and SmartBot.

Title: Electrically Actuated Origami Microrobots

Abstract: Micro/nano-origami technology enables the scalable fabrication of 3D micro-robots using planar processing techniques, demonstrating significant potential in fields such as biological micromanipulation. In this talk, I will first introduce a new type of micro-actuator based on electrochemical reaction. Combined with origami design principles, we developed a highly integrated micro-manipulation robot system with multi-modal motion capabilities. Then I will talk about the typical applications of the micro-robots, such as cell manipulation, conformal sensing, etc. In the future, this technological platform holds broad prospects in precision medicine applications, including minimally invasive surgery and targeted drug delivery.

Invited Speaker

14:30-14:50

Jizhai Cui

Fudan University

Bio: Jizhai Cui is a tenure-track associate professor at the International Institute for Intelligent Nanorobots and Nanosystems, College of Intelligent Robotics and Advanced Manufacturing, Fudan University. He obtained his Ph.D. in mechanical engineering from the University of California, Los Angeles, in 2016 and subsequently held postdoctoral appointments in the Department of Materials at ETH Zurich and the Paul Scherrer Institute. His research interests include intelligent micro- and nanorobots, origami/kirigami-inspired metamaterials, and nanomagnetic devices.

Title: Field-Programmable Shape Morphing in Microrobots

Abstract: Shape morphing is a defining capability for microrobots, enabling adaptive propulsion, controllable force generation, and reconfigurable functional interfaces in heterogeneous microenvironments. However, in many existing systems, morphing behaviors are largely hard-coded into geometry or material layout during fabrication, which restricts functional diversity and limits the ability to switch roles on demand. This talk integrates our recent studies to show how programmable and reprogrammable shape morphing can be elevated to a controllable control layer for microrobots.

I will first describe nanomagnetic encoding of origami-like micromachines, where arrays of single-domain nanomagnets with engineered switching fields are addressed by prescribed field sequences to store multiple morphing instructions on a single device. This approach enables one micromachine to transform into distinct target configurations and supports complex, multi-gait behaviors in modular microrobots. I will then introduce a purely magnetic, in-situ reprogramming strategy using coercivity-gradient nickel nanowire arrays embedded in SU-8 panels and linked by a soft hinge. By combining nanowires with distinct coercivities and tuning the field amplitude and ramp time, a single microrobot can deterministically switch its magnetization states and access multiple deformation/locomotion modes with millisecond-scale mode transitions.

Next, I will address terrestrial microrobot locomotion, where fluctuating friction often undermines propulsion asymmetry. Using laser-actuated VO_2 nanomembranes with hysteresis, we realize

nonreciprocal shape morphing that alternately modulates contact areas to generate stable friction asymmetry across diverse surfaces, and reinforcement learning further enables autonomous trajectory following. Finally, I will present waveguide microactuators self-rolled around an optical fiber taper, providing fast, laser-addressable bending for rapid capture and release of microorganisms. Together, these advances define transferable actuation primitives for reconfigurable microrobots toward biomedical micromanipulation, microassembly, and microsystem integration.

Invited Speaker

14:50-15:10

Shilun Feng

Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences

Bio: Dr. Shilun Feng is currently an Associate Professor at the Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, leading the Integrated Photoelectrochemical Biosensors Research Group. He completed his PhD at the School of Engineering, Macquarie University in 2019, under the supervision of Associate Professor David Inglis and Professor Ewa Goldys, a Fellow of the Australian Academy of Technological Science and Engineering (ATSE). He then conducted postdoctoral research at Nanyang Technological University, Singapore, where he was supervised by Professor Ai Qun Liu, a Fellow of the Academy of Engineering Singapore.

As an early-career researcher specializing in biomedical microfluidics and point-of-care testing (POCT) instruments, Dr. Feng has made significant contributions to the field. He has published more than 100 peer-reviewed journal articles (55 first/co-first/corresponding authors), most of which are published in Q1 journals. His work has garnered more than 2,400 citations, resulting in an h-index of 26. He holds 13 patents related to microfluidics for POCT applications. Dr. Feng has served as the Principal Investigator for 13 government and industry-funded grant, totally more than 3 million AUD. He is an active contributor to the academic community, having presented at over 20 national and international conferences, including MicroTAS 2022. He will also serve on the committee for MicroTAS 2025 in Adelaide, Australia. In addition to his research, Dr. Feng holds several associate editors for journal of Micromachines, Nanotechnology and Precision Engineering, and International Journal on Smart Sensing and Intelligent Systems. Dr. Feng leads a research team focused on integrated photoelectrochemical biosensors, with emphasis on sample sampling, processing and integrated detections, and the development of portable POCT systems. Several integrated systems developed by his team have been successfully translated into practical applications.

Title: Microfluidics-based Point-of-care testing（POCT）for Pathogens Detection

Abstract: Pathogen detection is critical to safeguarding public and national biosafety. However, traditional methods face limitations such as sampling with biosignals distortion, labor-intensive enrichment, and complicated detection instruments. To overcome these challenges, this study introduces an integrated

solution built upon three innovations based on using droplets:

1）Droplet-based sampling: A hydrophilic microporous needle-based sampling technique was developed to minimize sample signal distortion during transport caused by “Taylor dispersion”. Leveraging two-phase flow and interfacial tension, this method encapsulates samples within oil droplets immediately after collection, effectively reducing evaporation, preventing contamination, and preserving sample with temporal, chemical and spatial resolutions.

2）On-site processing: To eliminate manual, multi-step operations, an on-chip magnetic control module drives magnetic beads across droplet interfaces. This enables fully automated lysis, nucleic acid extraction, and amplification within microscale droplets streamlining the workflow, inside one enclosed microfluidic chip.

By combining these technologies, an integrated on-chip optoelectronic prototype was developed, which can complete pathogen detection within 30 minutes at a sensitivity of 5 copies/ μ L, supporting high-throughput testing of up to 96 samples. The system has been validated in real-world settings, including the local Hospital for detecting pathogens such as pneumonia viruses, rhinoviruses, and Bordetella pertussis, consistently delivering accurate and stable results.

3）Integrated optoelectronic detections: Conventional detections relies on bulky instruments and stable environments. In contrast, integrated photonic and electronic chips significantly reduce system size while enhancing stability and portability, enabling reliable detection outside traditional laboratory settings.

With its advantages of fast, accuracy, high throughput, and portability, this platform is well-suited for deployment in disease control centers, hospital laboratories, and on-site emergency testing. It holds strong industrialization potential and is expected to significantly strengthen public health emergency response capabilities.

Technical Sessions

D4-PM-A04: Micro/Nanofabrication and Sensor

13:30-15:30, April 20, 2026 **Meeting Room 302A**

Session Chair: Yan Wang, University of Electronic Science and Technology of China

Invited Speaker

13:30-13:50

Yan Wang

University of Electronic Science and Technology of China

Bio: Yan Wang

She obtained her Master ' s degree in Chemical Process Machinery from Zhejiang University during 2008 – 2011. From 2011 to 2015, she pursued and received her Ph.D. degree at the Institute of Thermal Process Engineering, Environmental and Natural Products Process Engineering, Technische Universität Bergakademie Freiberg (TU Bergakademie Freiberg), Germany. She worked at Central South University, China, from 2016 to 2021. She has been affiliated with the University of Electronic Science and Technology of China (UESTC) since 2021. She was selected for the Youth Talent Program under Sichuan Provincial "Tianfu Emei Plan". Her research focuses on electrical multi-sensors, flexible devices, microstructures and interconnections in packaging, CFD simulation, and optimization models.

Title: A Flexible Multimodal Sensing Microsystem and Its Application in Motion Monitoring

Abstract: Flexible multimodal sensors have demonstrated critical applications in health monitoring, human motion detection, and soft robotic sensing. However, the simultaneous achievement of multifunctionality, minimal signal crosstalk, and high sensitivity remains a persistent challenge. In this study, we developed multi-modal flexible sensors with a layered architecture that integrates distinct electrical parameters to detect pressure, proximity, humidity, and temperature. Through rational functional layer allocation, the compact sensor achieves independent signal transduction for each physical parameter. Experimental validation confirms its efficacy in real-time human respiratory monitoring, posture recognition, and precise object proximity detection. The sensor's multifunctional integration offers significant potential for sleep monitoring, healthcare IoT systems, and ambient intelligence applications, thereby advancing the development of next-generation wearable monitoring technologies.

Invited Speaker

13:50-14:10

Liaoyong Wen

Westlake University

Bio: Dr. Liaoyong Wen joined Westlake University in 2019 and became a Tenured Associate Professor in 2025. He earned his B.S. from Zhengzhou University (2006) and his Ph.D. from the University of Münster and the Technical University of Ilmenau, Germany (2016), followed by postdoctoral research at the University of Connecticut (2017–2019). His research focuses on intelligent fabrication of multiscale 3D metamaterials, their structure–performance relationships in optoelectronic devices and biosensors, and their integration into multifunctional, high-performance systems. He has published over 50 SCI-indexed papers in leading journals, including Nature Materials, Nature Nanotechnology, and Nature Communications, with an H-index of 36.

Title: Aluminum 3D Lithography: Enabling High-dimensional Metasurface for Advanced Sensing

Abstract: Complex structures are ubiquitous in biological systems. Over millions of years, biological systems have evolved optimized functions based on the beneficial size and material properties of their unit cells, which contribute to favorable mechanical and physical properties. Inspired by these biological systems, many trial-and-error reverse-engineering and computational methods have been utilized to mimic these structures for various applications. One of the most challenging aspects is manufacturing man-made systems with controllable features spanning multiple length scales, particularly down to the nanoscale, which significantly impacts the system's collective properties. I will introduce a new concept of aluminum-based 3D lithography (AL-3Dlitho) enabled by the aluminum surface work hardening phenomenon. Combining AL-3Dlitho with different deposition methods, various high-precise homogeneous and heterogeneous multiscale materials across at least 107 length scales could be designed and fabricated. Finally, I will talk about how to understand structure-property relationships and pursue desired properties by fully utilizing the customized multiscale structures on different length scales from nano-structures to macro-structures, including 3D plasmonic metasurface-based biosensors and multiscale heterointerface-based physical sensors, as well as their multifunctional integration.

Invited Speaker

14:10-14:30

Hao Zhang

Ocean University of China

Bio: Hao Zhang is currently associate professor with the Faculty of Information Science and Engineering, Ocean University of China, and the Deputy Director, Shandong Key Laboratory of Intelligent Sensing Chips and System, Qingdao, China. He received the PhD degree in electrical and computing engineering from the University of Saskatchewan, Canada, in 2019. He worked as a postdoctoral fellow in the Department of Electrical and Computer Engineering, University of Saskatchewan, Saskatoon, Canada from 2019 to 2020. His research interests include digital VLSI design, AI processor design, and marine AI

applications. He has published more than 40 research papers in the relevant fields. He is the principal investigator of key research projects in the field of efficient AI computation and intelligent sensor systems.

Title: The Convergence of AI and Sensors: Pushing the Limits of Intelligent Sensing Systems for Marine Applications

Abstract: With the rapid development of AI technologies, there is an increasing demand to apply AI in sensors for improved ability. For marine scenarios, this integration is not merely beneficial but essential for overcoming the severe limitations of conventional methods in ocean monitoring, exploration, and navigation, where data is often vast, noisy, and multimodal. In this talk, we will explore the current technologies of integrating AI and sensors. First, we will explore the technologies of using AI in sensor design and optimization for specific tasks. Second, we will see how AI can help with complex sensor data processing. Third, we will investigate the paradigm of in-sensor computing for extremely low-power end devices. Finally, we will discuss potential future trends of AI-sensor integration to motivate more research works in this emerging field.

Invited Speaker

14:30-14:50

Yu Zhou

Fudan University

Bio: Yu Zhou is currently an Assistant Professor at College of Future Information Technology in Fudan University. He received B.Eng. and Ph.D. degrees in Materials Science and Engineering from Tsinghua University in 2015 and 2020, respectively. Before joining Fudan University in 2026, he was a Postdoctoral Research Associate and Research Assistant Professor at the Department of Electronic and Computer Engineering in The Hong Kong University of Science and Technology. His research interest mainly focuses on optoelectronic devices based on micro-nano structures. He has published over 40 papers in esteemed journals, including Science Robotics, Nature Electronics, Nature Reviews Materials, Nature Communications, etc.

Title: Artificial Compound Eye with Perovskite Nanowire Retina

Abstract: Bioinspired vision provides an appealing route toward compact, multifunctional artificial visual systems. In this talk, I will present our recent progress in perovskite nanowire optoelectronics, spanning from biomimetic photosensitive elements to integrated vision platforms. We first develop perovskite nanowires as artificial photoreceptor units and demonstrate high-performance photodetectors with broadband and circularly polarized light sensing capabilities. Building on these advances, we integrate a hemispherical high-density perovskite nanowire image sensor array with a three-dimensionally printed honeycomb pinhole optical structure to realize an artificial compound eye. This system delivers an ultrawide field of view, accurate target localization, and motion tracking. Looking forward, integrating chiral nanowire photodetectors with this compound-eye architecture could open a path toward bioinspired circularly polarized vision. Overall, these results highlight perovskite nanowires as a versatile platform for next-generation intelligent vision systems in robotics and autonomous sensing.

Invited Speaker

14:50-15:10

Fei Wang

Southern University of Science and Technology

Bio: Fei Wang received his B.Eng. from the University of Science and Technology of China in 2003, and his Ph.D. degree in microelectronics from the Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Science in 2008, respectively. In 2008, he joined the Department of Micro- and Nano-technology, Technical University of Denmark, first as a Post-Doctoral Researcher and soon promoted to an Assistant Professor (2010-2013). In 2013, he joined Southern University of Science and Technology (SUSTech) in Shenzhen, where he is now a Professor in the School of Microelectronics. His current research interests include energy harvesting, MEMS and NEMS sensors, and semiconductor testing methods. Dr. Wang has been an Editorial Board member for Micromachine. He has served as the ETPC Member for the Transducers and the IEEE MEMS conferences and other international conferences. He has authored and co-authored more than 200 articles with H-index of 52, 4 books/chapters, and has filed more than 20 patents.

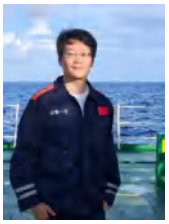
Title: MEMS Gas Sensors - From Nanomaterials, Microelectrodes to Machine Learning

Abstract: Recently, MEMS gas sensors have attracted more and more attention thanks to their compact size, high sensitivity and compatible fabrication process. Great efforts have been made to develop chemiresistive gas sensors based on metal-oxide semiconductor nanomaterials, for the potential applications such as gas emission monitoring for industrial plants, indoor and outdoor pollution detection, and breath analysis. Though many new materials and devices have been developed, there are still a few technical challenges for the MEMS gas sensors such as the process compatibility and the wafer-level testing for the device. This talk will report our recent works on (1) the new compatible fabrication technique for the sensing materials, and (2) the intelligent and fast test strategy with machine learning.

Invited Speaker

15:10-15:30

Yang Yang



Institute of Deep-sea Science and Engineering, Chinese Academy of Sciences

Bio: Dr. Yang Yang is a Professor and Ph.D. supervisor at the Institute of Deep-Sea Science and Engineering, Chinese Academy of Sciences. Dr. Yang earned his Ph.D. in Electronic Engineering from the IMEC in 2017. From 2017 to 2020, he worked at Osaka University in Japan and the Northwest Pacific National Laboratory in the United States. He returned to China in 2020 to join the Institute of Deep-Sea Science and Engineering, Chinese Academy of Sciences, where he currently focuses on research in marine electronics and intelligent

systems, physical oceanographic sensor technology, marine bioacoustic detection technology, and marine blue energy development and utilization. Dr. Yang is an author of over 40 SCI papers, ten US/Chinese patents.

Title: Fully Integrated Flexible Temperature – Depth Sensor for Deep-Ocean Applications with Neural Network Compensation

Abstract: Understanding the deep ocean is essential for advancing our knowledge of global circulation, ecosystem dynamics and climate processes. While conventional conductivity – temperature – depth sensors can provide excellent precision, their rigid and heavy construction restricts deployment on many emerging platforms, particularly those with curved or lightweight surfaces, thereby limiting progress toward distributed and platform-integrated ocean observation. These constraints motivate the development of flexible, compact sensing systems capable of surviving the extreme pressures of the deep sea.

Here, we present a fully integrated, flexible temperature – depth sensor capable of operating beyond 4812.2 m, enabled by a co-designed materials – mechanics – electronics – algorithm architecture. By combining a laser-induced graphene (LIG) sensing element, polydimethylsiloxane (PDMS) encapsulation, ultra-low-power electronics and dual-hidden-layer neural-network compensation, our device addresses the long-standing challenges of range limitation, temperature drift and lack of integrated low-power systems in flexible sensors.

Technical Sessions

D4-PM-A05: Micro/Nano/Molecular Physical/Chemical Sensors/Actuators

13:30-15:30, April 20, 2026 **Meeting Room 302B**

Session Chair: Jing Jin, Harbin Institute of Technology, Shenzhen

13:30-13:45	**Paper ID:** Oral# 98 **Paper Title:** Surface Acoustic Wave Modulation of H2S Sensing in SnO2 Thin Films **Presenter:** Yanghui Liu, Huazhong University of Science and Technology
13:45-14:00	**Paper ID:** Oral# 134 **Paper Title:** A Precise Calibration Method via Confined-Microfluidics for Hydrogel-Based Electrochemical Sensors **Presenter:** Wenjun Li, Tianjin University
14:00-14:15	**Paper ID:** Oral# 145 **Paper Title:** A Double-Layer Non-Magnetic Heating Film and Temperature Control System for SERF Atomic Magnetometers **Presenter:** Zheng Xing, Tianjin University
14:15-14:30	**Paper ID:** Oral# 158 **Paper Title:** A Multimodal Tactile Sensor for Object Hardness Recognition **Presenter:** Jiaxuan Wu, Shenzhen University
14:30-14:45	**Paper ID:** Oral# 213 **Paper Title:** Hydrogen Sensor with Dual-bridge Topology Achieving Sub-ppm Detection Through Uniform Temperature Contorl **Presenter:** Wenxuan Zhi, Xi'an Jiaotong University
14:45-15:00	**Paper ID:** Oral# 259 **Paper Title:** A Simple and Universal Laser Direct Writing Platform: From Metal Salt Precursors to Diverse Porous Metal Oxide Sensors for Room-Temperature parts-per-billion-Level Toxic Gas Detection **Presenter:** Yaming Hu, Huazhong University of Science and Technology
15:00-15:15	**Paper ID:** Oral# 314 **Paper Title:** Design and Fabrication of a Multi-Spring Large-Mass MEMS Accelerometer for Microseismic Detection in Geological Exploration **Presenter:** Lianjun Wu, CRRC Academy (Qing Dao) Co., Ltd.
15:15-15:30	**Paper ID:** Oral# 315 **Paper Title:** Anti-Parity – Time Symmetric PZT Resonators **Presenter:** Jiajun Wang, Hangzhou Dianzi University

Technical Sessions

D4-PM-A06: Non-linear Mechanisms Enabled M/NEMS

13:30-15:05, April 20, 2026 **Meeting Room 305**

Session Chair: Cao Xia, Sichuan University

Invited Speaker

13:30-13:50 **Zhan Shi**

Westlake University

Bio: Zhan SHI received the Ph.D. degree in Dynamics and Control from Zhejiang University in 2024. He is currently a postdoctoral researcher at Westlake University. His research focuses on nonlinear dynamics in micro- and nano-electromechanical systems (M/NEMS) and acoustically driven robotic systems. He has published first-author papers in leading journals, including Nature and Science Advances, and has received several awards at major international conferences. He also serves as a reviewer for journals such as Science Advances.

Title: Synchronization Mechanisms and Cross-Scale Applications in Nonlinear Micro-Oscillators

Abstract: Synchronization in nonlinear micro- and nano-oscillators provides a powerful platform for uncovering complex coupled dynamics and achieving high-precision control in M/NEMS. This talk focuses on the physical mechanisms and regulation strategies of synchronization in nonlinear oscillatory systems. In particular, this talk highlights how nonlinear effects can reduce synchronization time, broaden synchronization bandwidth, and enhance frequency stability, and elucidates the underlying mechanisms through dynamical modeling and theoretical analysis. These results offer theoretical insights and design inspiration for high-performance sensing, signal processing, and robust operation of microscale systems. In addition, the talk explores cross-scale applications of synchronized motion in acoustic robotic systems,

Invited Speaker

13:50-14:10 **Xiang Zhao**

Southwest Petroleum University

Bio: Professor Zhao Xiang is a distinguished Professor and Doctoral Supervisor at Southwest Petroleum University, recognized as an Overseas High-Level Talent of Sichuan Province. He holds a Ph.D. in Engineering from Southwest Jiaotong University, trained under Professors Li Xiangyu and Li Yinghui. His research focuses on structural vibration control, dynamic behaviors of cracked systems, energy harvesting, and vortex-induced vibrations. He serves as Secretary-General of the Sichuan Provincial Committee for Dynamics and a Senior Member of the Chinese Society of Vibration Engineering. Professor Zhao has led three National Natural Science Foundation of China projects (including two General Projects), two key laboratory open projects, and over ten petroleum industry projects with total funding exceeding RMB 6 million. His research has yielded 56 publications, including 24 first-author or corresponding author SCI papers, 13 Top journal articles, and two ESI Highly Cited Hot Papers. His vibration mitigation methods have been acknowledged by Academicians Zhu Weiqiu and Wen Bangchun as providing critical guidance for vibration control, and by ASME Academician Liao Weixin for advancing precise modeling of coupled systems. As Course Leader for Structural Vibration and Control, he authored a 3A-press textbook and led four university-level teaching reforms. He received the China Vibration Engineering Society Science & Technology Award (Second Prize, lead recipient) and the Southwest Petroleum University Graduate Teaching Achievement Award (Third Prize, lead recipient). He also serves as an Editorial Board Member for International Journal of Dynamic and Control.

Title: A Closed-Form Solution of Forced Vibration of a Micro/nano Curved-Beam Systems by Means of the Green's Function Method

Abstract: Micro/nano curved-beam systems (MNCBSs) are increasingly critical in microelectromechanical systems (MEMS) for advanced applications such as high-sensitivity resonators, accelerometers, and nanoscale sensors, where precise vibration and noise suppression are essential for device performance and stability at the micro/nano scale. Compared to straight micro/nano beam systems, MNCBSs exhibit superior efficiency in vibration control due to their inherent geometric flexibility, which is particularly advantageous for enhancing the signal-to-noise ratio and operational reliability of MEMS devices. This paper presents a closed-form solution for the steady-state forced vibration of an MNCBS, utilizing the classical Euler-Bernoulli beam model adapted for microscale dynamics. Green's function and Laplace transform methods are systematically applied to derive the fundamental solution, which serves as a general framework applicable to arbitrary boundary conditions, a key requirement for MEMS design flexibility. Numerical results are rigorously validated against established reference solutions, confirming the accuracy and robustness of the proposed approach. Parametric studies investigate the influence of critical geometric parameters (e.g., radii of curvature, beam thickness) and physical properties (e.g., material density, elastic modulus) on vibration responses, with particular emphasis on the interplay between the elastic layer stiffness and the MNCBS dynamics. Results demonstrate that the MNCBS can be seamlessly degenerated into a straight micro/nano double-beam system by setting the radii of curvature to infinity, or reduced to a hybrid configuration where one beam is straight and the other curved—both

scenarios offering valuable design insights for optimizing MEMS structures with tailored vibration characteristics. This work provides a foundational analytical tool for the development of next-generation micro/nano-scale vibrational control systems in MEMS.

Invited Speaker

14:10-14:30 **Yisen Wang**

Lanzhou University

Bio: Yisen Wang is a Youth Researcher at the School of Physical Science and Technology, Lanzhou University, and a master's supervisor. He obtained his Ph.D. in Theoretical Physics from Lanzhou University in 2018 under Prof. Liang Huang, following a B.S. degree from China University of Mining and Technology in 2012. After completing his doctorate, he conducted faculty postdoctoral research at the School of Mathematics and Statistics, Lanzhou University. His research interests lie in nonequilibrium statistical physics and nonlinear dynamics of nanoscale systems, with an emphasis on thermal transport and collective dynamics. He is a member of the Organizing Committee of the Workshop on Thermal Transport, and a referee for journals such as the Physical Review series, New Journal of Physics, and Chinese Physics B. He currently leads an NSFC General Program (2026 – 2029) and has completed multiple nationally and provincially funded projects, while participating in several major collaborative research and industry-commissioned projects.

Title: Parity Mixing Transition in Graphene Nanoresonators

Abstract: Nanomechanical resonators have become central elements in applications ranging from ultra-sensitive sensing to signal processing, yet their ultimate performance is set by intrinsic relaxation arising from nonlinear intermodal couplings. Most control schemes operate in the spectral domain, e.g., adjusting mode frequencies to activate internal-resonance channels. In crystalline devices, however, couplings are further constrained by symmetry-imposed selection rules, and their impact on energy relaxation landscape of such devices remains largely unexplored. Here, we demonstrate a sharp transition in intrinsic relaxation of symmetric circular graphene resonators, manifested as a parity-mixing transition where the time for energy to equilibrate between even- and odd-parity sectors increases by about an order of magnitude at a critical energy, sticking out from the typical monotonic decrease. This anomaly is driven by a qualitative restructuring of the inter-parity energy transfer channels mediated by parametric resonance. Finally, we propose a practical strain-tuning scheme to shift the critical energy threshold and thereby control the transition. These results show that symmetry provides an effective handle to control intrinsic dissipation at the nanoscale and to realize nanomechanical resonator devices with programmable intermodal energy flow.

Invited Speaker

14:30-14:50 **Hongxiang Han**

Jilin University

Bio: Hongxiang Han received the B.E. and D.E. degree in mechanical engineering from Jilin University, Changchun, China, in 2018 and 2025, respectively. He is currently working as an assistant researcher at Micro Engineering and Micro Systems Laboratory of Jilin University (JML), Changchun, China. His current research concentrates on resonant galvanometer and its engineering applications.

Title: Passive Noninvasive Resonant Galvanometer for WSN: Research Status, Forefront and Challenges

Abstract: Resonant galvanometer is a kind of current sensor based on the magnetic effect of electric current, which converts current parameters into changes in the resonant characteristics (such as frequency or amplitude) of the sensing unit. It usually consists of three parts: a magnetic sensing structure, a resonant structure, and a transduction structure. Due to the advantages of non invasiveness, strong anti-interference ability, low overall power consumption, and high stability, it has strong applicability in real-time monitoring of current in various devices. In recent years, with a series of new requirements for sensor technology such as integration, intelligence, and networking in the era of the Internet of Things, resonant galvanometers based on amplitude response have shown great potential for development in three-phase current monitoring scenarios such as smart grid transformation, wireless sensor network construction, and intelligent device monitoring, due to their ease of integration with Micro Electro Mechanical System (MEMS) technology to achieve miniaturization. This report will focus on exploring the basic principles and improving performance indicators of resonant current sensors, and consider its application forefront and challenges for wireless sensor networks.

Oral Presentation

14:50-15:05	**Paper ID:** Oral# 378 **Paper Title:** A Tunable NEMS Filter Based On 1:1 Internal Resonance **Presenter:** Yikun Liu, Sichuan University

Technical Sessions

D4-PM-A07: Micro/Nano Integrated Devices/Circuits/Systems

13:30-15:30, April 20, 2026 **Meeting Room 306**

Session Chair: Qianli Jia, Aerospace Information Research Institute, CAS

13:30-13:45	**Paper ID:** Oral# 58 **Paper Title:** An Elastic Hybrid Nanogenerator with Dual-Mode Sensing for Compact Active Microsystems **Presenter:** Fang Liu, University of Electronic Science and Technology of China
13:45-14:00	**Paper ID:** Oral# 59 **Paper Title:** Nanowire Multifunctional Sensor Integrated Wearable Self-Powered Wireless Microsystem **Presenter:** Zheng Wei, University of Electronic Science and Technology of China
14:00-14:15	**Paper ID:** Oral# 60 **Paper Title:** All-Printed Finger-Inspired Tactile Sensor Array for High-Resolution Microscale Texture Sensing and 3D Reconstruction **Presenter:** Ruilai Huang, University of Electronic Science and Technology of China
14:15-14:30	**Paper ID:** Oral# 61 **Paper Title:** Reduced Graphene Oxide-Based Flexible Ultralight Smart Patch with a Streamlined Sensing Array for Hand Gesture Detection **Presenter:** Xiang-Ran Huang, University of Electronic Science and Technology of China
14:30-14:45	**Paper ID:** Oral# 112 **Paper Title:** A Biomimetic Integrated Chip for Active, Rapid, and Controllable Transdermal Epinephrine Delivery **Presenter:** Chenxi Jin, Tianjin University
14:45-15:00	**Paper ID:** Oral# 250 **Paper Title:** An Efficient Algorithm for Adaptive Threshold Bit-Flipping Decoding in 3D NAND Flash **Presenter:** Zihao Cui, Shandong Yunhai Guochuang Innovative Technology Co., Ltd.
15:00-15:15	**Paper ID:** Oral# 261 **Paper Title:** Micro-Nano Sensing Detection System for Intracellular Electrophysiological Recording **Presenter:** Dongxin Xu, Zhejiang University
15:15-15:30	**Paper ID:** Oral# 270 **Paper Title:** An on-Chip Mode-Multiplexing Circuit Realizing Time-Efficient Operations for Large-Scale RRAM Arrays Based on 55 nm CMOS Process **Presenter:** Keqin Li, Huazhong University of Science and Technology

Technical Sessions

D4-PM-A08: Biomimetic Microelectromechanical Systems (MEMS) Technology

13:30-15:10, April 20, 2026 **Meeting Room 307**

Session Chair: Junqiu Zhang, Jilin University

Invited Speaker

13:30-13:50 **Kai Tao**

Northwestern Polytechnical University

Bio: Professor Kai Tao is a faculty member in the School of Mechanical Engineering at Northwestern Polytechnical University. Since February 2017, he has been leading a research team in the Department of Microsystem Engineering at Northwestern Polytechnical University. His research interests focus on the smart flexible sensing systems, especially hydrogel sensing systems, and their applications in human-machine intefaces (HMIs). He has published over 100 papers and has been cited over 10000 times with an H-index of 55, according to Google Scholar. 23 of his papers have been recognized as highly cited papers or hot papers (Web of Science ESI). He was selected for the National Youth Talent Program and listed in the World's Top 2% Scientists by Stanford (2022-2025, top 0.5% in 2025). He also serves as an editor for several international journals and a general/session chair for IEEE INEC, IEEE/ASME AIM, and VEH (2021-2023) international conferences.

Title: Hydrogel Electronic Skin for Human-Machine Interaction System

Abstract: Hydrogels have become promising flexible sensing materials for electronic skins (E-skins) due to their outstanding mechanical properties, conductivity, biocompatibility, and multi-stimulus responsiveness. The report describes the recent research progress of our group on organic ionic hydrogel sensors based on MEMS fabrication processes and lithium bromide regulation techniques. These hydrogel sensors possess multiple functions, including high-sensitivity pressure sensing and high-precision recognition of material types and surface roughness. Combined with multimodal sensing modules and artificial intelligence (AI) algorithms, the sensing system can perform high-precision motion intention decoding of electromyographic (EMG) signals and forcemyography (FMG) signals, enabling three-degree-of-freedom motion control of drones through gestures as well as motion control of drone swarms. It can be used for active rehabilitation training involving voluntary motion intentions, proposing a novel and simple control strategy for the design of next-generation multimodal interaction systems.

Invited Speaker

13:50-14:10

Renxin Wang

North University of China

Bio: Dr. Renxin Wang received the B.S. degree in Tianjin University, in 2008. He received the Ph. D degree at the Institute of Microelectronics, Peking University in 2013. He was a visiting scholar at University College London. Presently, he is a professor at State key Laboratory of Extreme Environment Optoelectronic Dynamic Measurement Technology and Instrument, North University of China. He is engaged in the research of MEMS hydrophone and ultrasonic transducer. As the principal investigator, he has led projects supported by the National Key R&D Program of China (Young Scientist Project), NSFC(Excellent Young Scientists Fund),etc. He has published over 50 peer-reviewed papers in leading journals including IEEE Transactions on Industrial Electronics, Microsystems & Nanoengineering. He has been granted more than 20 national invention patents and awarded the Second Prize of Natural Science Award of Shanxi Province.

Title: Research on Capacitive Micromachined Ultrasonic Transducer Technology and Applications

Abstract: Compared with conventional piezoelectric transducers, capacitive micromachined ultrasonic transducers (CMUTs) exhibit numerous advantages, including excellent impedance matching with human tissue, wide bandwidth, high sensitivity, superior electromechanical conversion efficiency, and great potential for large scale integration. This report focuses on the design, fabrication, and applications of CMUTs. Firstly, simulation analyses are conducted to investigate the performance optimization of CMUTs. Secondly, the manufacturing processes and characterization methods are systematically presented, with emphasis on underwater acoustic packaging technologies. Finally, the progress of CMUTs in alcohol concentration detection, underwater pressure sensing, and ultrasonic imaging are discussed.

Invited Speaker

14:10-14:30

Aihong Ji

Nanjing University of Aeronautics and Astronautics

Bio: Prof.Aihong Ji is a Researcher at Nanjing University of Aeronautics and Astronautics (NUAA), serving as Director of Jiangsu Key Laboratory of Bionic Materials and Equipment. His main research interests focus on Unmanned Aerial Vehicles (UAVs), Robotics, and Intelligent Equipment. He has presided over more than 40 research projects. He has published over 100 SCI/EI-indexed papers (including 1 ESI high-level paper), authored 2 monographs, participated in compiling 2 monographs, and been granted more than 30 invention patents. His achievements have won him several awards, such as the Second Prize of Jiangsu Science and Technology Award, the Second Prize of Natural Science Award of the Ministry of Education, the Second Prize of Technological Invention Award of the Ministry of Education, and the Gold Medal at the 39th International Exhibition of Inventions of Geneva.

Title: A Novel Drone Endoscope System for Near-Surface Observation in Fusion Reactor Vacuum Chambers

Abstract: A novel drone endoscope system (DES) for internal observation in fusion reactors enables autonomous location and mapping in Global Navigation Satellite System (GNSS)-denied and dark en-vironments in narrow, conffned vacuum chambers. A computational ffuid dynamics (CFD) simulation analysis was conducted to investigate the impact of nonlinear airffow interference introduced by internal chamber structural surfaces on the DES. Speciffcally, the inffuence of ceiling, ground, and wall surface effects is consid-ered, and the nearest limiting safety distances for near-surface information acquisition are derived. Subsequently, the DES is employed to inspect the 1/8 vacuum chambers of the China Fusion Engineering Test Reactor (CFETR). The system exhibits ffight stability with ±0.03 m positional accuracy and ±3◦ angular error, enabling the acquisition of images of the internal chamber surfaces and three-dimensional reconstruction. This represents a novel approach to the internal observation mission of the fusion reactors.

Invited Speaker

14:30-14:50

Yonggang Jiang

Beihang University

Bio: Yonggang Jiang is currently a professor with the School of Mechanical Engineering and Automation, Beihang University. His research interests include nano/micro manufacturing, bionic sensing, and bionic intelligent Microsystems (MEMS). He is a co-inventor on more than 30 patents and has published more than 100 papers in peer-reviewed journals such as Nat. Commun., Sci. Adv., Microsyst. Nanoengin. etc. He developed polyimide-based flow and pressure sensor array for flight parameter estimation and SiC-based high-temperature pressure and temperature sensors. .His research has been recognized by several awards, including has received the Second Prize for Technological Invention from the China Instrument and Instrumentation Society (ranked first), and the Second Prize for Technological Invention from the Ministry of Education (ranked second), and Mechanical Industry Science and Technology Award (Second Prize in 2022), Beijing Novel program (2014).

Title: Bio-Inspired Sensor System for Underwater Flow Sensing

Abstract: Underwater robots are increasingly being used for archaeological salvage, environmental exploration, and biodiversity observation. Due to the complexity of the underwater environment, these robots require multi-mode sensors to achieve stable navigation and attitude control. Inspired by the dual-mode perception principle of the fish lateral line for pressure and flow velocity, we have developed a variety of pressure and flow velocity sensors suitable for underwater applications, addressing the limitations of existing sensors in terms of conformal capability and sensitivity. By integrating calorimetric flow velocity sensors into microfluidic channels, we have developed a differential pressure sensing array that enables the proprioceptive perception of various underwater vehicle attitudes. Additionally, through neural network learning, we have achieved the capability to locate underwater vortex sources. This report

presents our recent progress in the field of bio-inspired sensor system for underwater flow sensing.

Invited Speaker

14:50-15:10

Lin Xu

Jiangsu University

Bio: I'm a Professor and PhD Advisor at Jiangsu University, and I'm on the committees for the Micro/Nano Manufacturing Technology and Biomanufacturing branches of the Chinese Mechanical Engineering Society. My research sits at the intersection of bionic robotics and flexible sensing, focusing on exciting new areas at the forefront of these fields. I've led a number of national and provincial research projects, including several funded by the National Natural Science Foundation of China and the Jiangsu Provincial Natural Science Foundation. My work has been recognized with a few awards, like the Science and Technology Award from the Jiangsu Provincial Consulting Association and the Innovation Excellence Award from the China Industry-University-Research Collaboration Association. I've also been lucky to publish a lot of my work as a first or corresponding author in top international journals like Advanced Functional Materials and Soft Robotics, with several papers even making the cover of journals like ACS Macro Letters, Chinese Journal of Polymer Science, and the Journal of Bionic Engineering. On top of that, I've contributed as a co-author to some really prestigious publications, including Science Robotics.

Title: Bioinspired Smart Materials and Soft Robotics

Abstract: Bioinspired smart materials exhibit stimuli-responsive behavior, dynamically modulating their physicochemical properties and macroscopic morphologies in response to external stimuli (e.g., photic, thermal, electrical, or hygroscopic stimuli), enabling their broad integration into soft robotic systems.However,a critical technological barrier persists: existing soft actuators require either artificial energy input, complex external field modulation, or cyclical stimulus alternation—all of which violate the essential requirements for autonomous operation in unstructured environments. Inspired by biologicalsystems, researchers are now focusing on embodied intelligence,imbuing soft robots with self-sustained motility and closed-loop autonomy akin to living organisms.Thecritical challenge lies in engineering intrinsic feedback mechanisms to achieve stimulus-driven autonomy without external control.Our study focuses on advancing soft robotics toward higher efficiency, flexibility, and intelligence through structural design and material innovation.

Technical Sessions

D4-PM-A09: Surface/Interface Functional Electronics & Micro/Nano Integrated Devices/Circuits/Systems

13:30-15:00, April 20, 2026 **Meeting Room 308**

Session Chair: Ya Wang, Beijing Normal-Hong Kong Baptist University

13:30-13:45	**Paper ID:** Oral# 231 **Paper Title:** Biodegradable Dual-Stimuli Hydrogel Scaffoldoid Synergizing Piezoionic and Lithium-Ion Release for Critical-Sized Bone Defect Regeneration **Presenter:** Guanbo Min, Beijing Institute of nanoenergy and nanosystems, Chinese academy of science
13:45-14:00	**Paper ID:** Oral# 234 **Paper Title:** Synergistic Contact-Electro-Catalysis and Photocatalysis in TiO2@PTFE Composites for Efficient Ambient Nitrogen Fixation **Presenter:** Kaiyang Shi, Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Science
14:00-14:15	**Paper ID:** Oral# 292 **Paper Title:** Laser-Fabricated Reconfigurable PT-Symmetric LC Sensors for Long-Range Wireless SHM of CFRP Structures **Presenter:** Wei Yue, Tsinghua University
14:15-14:30	**Paper ID:** Oral# 326 **Paper Title:** Super-Resolution Plantar Pressure Monitoring Based on Porous Nanocomposites with Hierarchical Microstructure Design **Presenter:** Yunjian Guo, Beijing University of Posts and Telecommunications
14:30-14:45	**Paper ID:** Oral# 358 **Paper Title:** Broadband Topological SAW Energy Localization via PnC Heterostructures **Presenter:** Tianqi Fan, Hangzhou Dianzi University
14:45-15:00	**Paper ID:** Oral# 415 **Paper Title:** Digitizing Clinical Palpation via a Wireless, Multimodal Tactile Glove **Presenter:** Yaozheng Wang, Peking University

Technical Sessions

D4-PM-A10: Micro Biosensing and Micro Manipulation & Micro/Nano – Bio-/Medical Devices and Systems

13:30-15:00, April 20, 2026 **Convention Hall A**

Session Chair: Xing Chen, Beihang University

13:30-13:45	**Paper ID:** Oral# 262 **Paper Title:** Research and Application of Multifunctional Sensing and Regulatory System of Cardiomyocytes **Presenter:** Jiaru Fang, Zhejiang University
13:45-14:00	**Paper ID:** Oral# 324 **Paper Title:** Real-Time Measurement of Single-Cell Rotation Speed WithOET System **Presenter:** Dongze Gai, Shenyang Jianzhu University
14:00-14:15	**Paper ID:** Oral# 355 **Paper Title:** A 3D Numerical Modeling Framework Based on Particle Trajectories for Optimized Pillar Design in DLD Microfluidics **Presenter:** Xiwei Huang, Hangzhou Dianzi University
14:15-14:30	**Paper ID:** Oral# 371 **Paper Title:** Synergistic Multi-crRNA-Triggered Cas12a System Integrated with a Vest-pocket Device for Rapid Detection of BK Virus in Urine **Presenter:** Yi Li, Chongqing Medical University
14:30-14:45	**Paper ID:** Oral# 381 **Paper Title:** Tailing-Actuated Interfacial Liquid Mixing (TAIL-Mix) Enables Efficient Nucleic Acid Extraction and Integrated HPV Genotyping in Digital Microfluidics Platform **Presenter:** Jiajian Ji, University of Science and Technology of China
14:45-15:00	**Paper ID:** Oral# 407 **Paper Title:** Silicon Nanowire Field-Effect Biosensors Enabled by Highly Uniform Aptamer Monolayers for the Detection of Melatonin as Sleep Disorder Biomarker **Presenter:** Qianhui Wei, GRINM (Guangdong) Institute for Advanced Materials and Technology

Technical Sessions

D4-PM-A11: Radio Frequency Micro/Nanodevices

13:30-15:20, April 20, 2026 **Convention Hall F**

Session Chair: Haoshen Zhu, South China University of Technology

D4-PM-A11: Radio Frequency Micro/Nanodevices

13:30-15:20, April 20, 2026 **Convention Hall F**

Session Chair: Haoshen Zhu, South China University of Technology

Keynote Speaker

13:30-14:00 **Jing Liu**

Tianjin University

Bio: Jing Liu is currently a Professor at the School of Precision Instrument and Opto-Electronics Engineering, Tianjin University, where she also holds the position of vice director at the Tianjin Key Laboratory of Intelligent Sensing Technology. She received her Ph.D. degree in Biomedical Engineering from University of Michigan-Ann Arbor in 2012. Her primary research focuses on the manipulation of physical properties in low-dimensional materials and the development of related information-functional devices for applications in sensing, memory, and logic computing. As a first or corresponding author, she has published over 60 SCI-indexed papers in high-impact international journals, including Nature Materials, Science Advances, and ACS Nano, which have garnered more than 4,000 SCI citations. In addition to her research, Professor Liu serves as an Associate Editor for AIP Advances (published by the American Institute of Physics), an Editorial Board Member of Micromachines, and a Young Editorial Board Member of National Science Open.

Title: Ambipolar Degeneracy Breaking in Two-Dimensional Materials via Surface Acoustic Wave

Abstract: Two-dimensional (2D) materials hold immense potential for next-generation information devices due to their ambipolar transport and tunable electronic states. However, conventional electric-field-driven architectures suffer from inherent carrier-type degeneracy: electrons and holes generate unidirectional currents, leading to ambiguous state overlaps in multi-level operation. Here, we demonstrate that surface acoustic waves (SAWs) break this symmetry in optically reconfigurable MoTe2/h-BN heterostructures. SAWs induce type-II band modulation in the heterostructure and spatially separate electrons and holes into distinct valleys, enabling bidirectional acoustoelectric currents, whose polarity reverses with carrier type, controlled dynamically via ultraviolet (UV) illumination and gating.

Leveraging this mechanism, we realize an 8-state memory device where SAW-driven readout currents changed between positive and negative polarities, achieving enhanced inter-state differentiation compared to voltage-read schemes. For synaptic applications, SAW-driven weight updates in nand p-type regimes produce anti-symmetric conductance trajectories, eliminating state collisions observed in electric-field-driven counterparts. This work pioneers acoustic wave manipulation of ambipolar transport, offering transformative strategies for degeneracy-free, high-precision neuromorphic electronics.

Invited Speaker

14:00-14:20

Wei Luo

Huazhong University of Science and Technology

Bio: Prof. Wei Luo received the B.S. degree in electronic science and technology and the Ph.D. degree in microelectronics and solid state electronics from the Huazhong University of Science and Technology, Wuhan, China, in 2004 and 2009, respectively. From 2009 to 2012, he was a Postdoctoral Fellow in the Department of Electrical and Information Engineering, Huazhong University of Science and Technology. In 2012, he joined the School of Optics and Electronic Information, Huazhong University of Science and Technology. From 2014 to 2016, he was a visiting scholar in the University of Michigan, Ann Arbor, USA. He is currently a Professor and assistant Dean with the School of Integrated Circuits, Huazhong University of Science and Technology. His research interests include high-frequency acoustic MEMS sensors for application in harsh environment, intelligent microsystems.

Title: Wireless Passive Surface Acoustic Wave Gas Sensors

Abstract: This report introduces the recent advancements made by our research group in the development of wireless passive surface acoustic wave gas sensors for extreme space environments, such as low temperature and high vacuum. The progress is presented from three aspects: materials, device design, and wireless testing. Specifically: 1) Development of a silver oxide/copper-coated oxide material system enabling rapid detection of hydrogen sulfide by semiconductor materials under low-temperature vacuum conditions; 2) Establishment of a full-link model for wireless sensors, based on which a novel surface acoustic wave exceptional point sensing mechanism is proposed, improving the resolution and sensitivity of gas sensors by ninefold; 3) Invention of a new two-dimensional interdigital electrode structure that enhances the wireless readout distance of the sensor.

Invited Speaker

14:20-14:40

Liang Gao

Southeast University

Bio: Dr. Liang Gao received his B.Eng. in electronic information science and technology from Sun Yat-sen University in June 2018, and his Ph.D. in electrical engineering from City University of Hong Kong in July 2022. Following his doctoral studies, Dr. Liang Gao served as a postdoctoral fellow at the State Key Laboratory of Terahertz and Millimeter Waves at City University of Hong Kong from August 2022 to February 2023. He then joined the CoSMIC Lab. at Columbia University as a postdoctoral research scientist in March 2023. Currently, Dr. Liang Gao is a Professor at the School of Information Science and Engineering, Southeast University. His research focuses on developments in integrated circuits and systems for high-frequency applications. His contributions are well-recognized, with over 10 journal and conference papers, including highly prestigious publications such as the IEEE Journal of Solid-State Circuits (JSSC) and the International Solid-State Circuits Conference (ISSCC).

Title: Large-Scale CMOS Terahertz Radiator Array

Abstract: The terahertz (THz) spectrum (0.1 THz – 10 THz) plays a crucial role in 6G high-speed communications, as well as in non-invasive imaging and spectroscopy. Among competing platforms, silicon-based integrated circuit (IC) technology is particularly attractive due to its commercial viability, high yield, and potential for compact, cost-effective integration. However, generating high-power THz signals above 300 GHz remains a formidable challenge, as the maximum oscillation frequency (fmax) of standard CMOS transistors is typically limited to around 300 GHz. In this talk, I will present our development of coherent THz radiator array chips fabricated in a standard CMOS process. By leveraging innovative array architectures and advanced design methodologies, we have systematically extended the boundaries of operating frequency, array scale, and radiated power. Notably, we have achieved tens of milliwatts of radiated power at approximately 670 GHz, setting a new benchmark for both array scale and radiated power in silicon-based technologies above the 300 GHz.

Invited Speaker

14:40-15:00

Feihong Bao

University of Electronic Science and Technology of China

Bio: Feihong Bao received the Ph.D. degree in Circuits and Systems from University of Electronic Science and Technology of China (UESTC), Chengdu, China, in 2020. And then he joined Shanghai Huawei Technology Co., Ltd, Shanghai, China, as a Radio Frequency Engineer. From 2021 to 2023, He joined Fudan University, Shanghai, China, as a Postdoctoral Researcher. He is currently an Associate Professor with the Yangtze Delta Region Institute (Huzhou) and School of Electronic Science and Engineering, UESTC. His research field include RF MEMS, acoustic wave devices, telecommunication front-end technologies, and flexible devices.

Title: Bandwidth Reconfigurability of SAW Filters via IDT Configuration for 5G Multi-Band Monolithic Integration

Abstract: This talk presents a reconfigurable surface acoustic wave (SAW) ladder filter design for monolithic multi-band integration in 5G systems, enabling precise reduction of ineffective (out-of-band) bandwidth through controlled reconfiguration of the resonator's effective electromechanical coupling coefficient (k 2 eff) via interdigital transducer (IDT) electrode configuration adjustments. By modifying the positiveto-negative electrode ratio, the electric field intensity is modulated, thereby achieving reconfigurable k 2 eff. Finite element method (FEM) simulations demonstrate the resulting changes in electric field distribution and k 2 eff. In the simulation, the k 2 eff of the series resonator was reduced by half through this approach, and the bandwidth of the constructed n78 and n79 filter was tuned. Experimental results confirm the reconfigurability, with the series resonators in n78 and n79 bands exhibiting a halved k 2 eff, which effectively narrows the filter bandwidth while preserving the series resonance frequency. This approach paves a promising path for future monolithic tunable SAW resonators and filters in 5G and beyond.

Invited Speaker

15:00-15:20

Shuyan Zhu

Sun Yat-sen University

Bio: Dr. Shu-Yan Zhu received the Ph. D. degree in Electronic Engineering from City University of Hong Kong in 2019. From 2019 to 2021, he was a Postdoctoral Fellow and Research Fellow with the City University of Hong Kong. Dr. Zhu is the recipient of Gold Model in the 48th and 49th International Exhibition of Inventions Geneva in 2023 and 2024, the Best Student Paper Award (Second Prize) at the International Conference on Microwave and Millimeter Wave Technology 2025 (IEEE ICMMT2025). He holds 4 US granted patents and has authored or coauthored over 30 referred journal and conference papers. He has served as the TPC Chair or session Chair for many international conferences, such as the Global Symposium on Millimeter-Waves & Terahertz (GSMM) 2024, the IEEE 12th Asia-Pacific Conference on Antennas and Propagation (APCAP) 2023, Asia-Pacific Microwave Conference (APMC) 2022, IEEE MTT-S International Microwave Workshop Series on Advanced Materials and Processes for RF and THz Applications (IMWS-AMP) 2022, etc. He is currently an Associate Professor with the School of Microelectronics Science and Technology, Sun Yat-sen University (SYSU), China. His current research interests include terahertz (THz) antennas and nanoplasmonics devices, microwave/RF circuits, nanofabrication technology, and optofluidic laboratory-on-chip devices.

Title: Silicon-based Terahertz High Frequency Metasurface Antennas

Abstract: With the continuous development of mobile communication from 3G, 4G to 5G, the working frequency band of antennas has gradually risen from microwave to millimeter wave, and the research work and industrial manufacturing technology related to millimeter wave antennas serving 5G communication

are becoming more and more mature, but the research on terahertz antennas applied to the next generation of 6G wireless communication has progressed slowly. This talk will reports our latest work of silicon-based terahertz (THz) high frequency metasurface antennas. To the best of our knowledge, our proposed Si-based THz metasurface antennas including Fabry-perot cavity antennas, reflectarray antennas, orbit angular momentum antennas and leaky-wave antennas demonstrate high performance and increased the operation frequency over 300 GHz, which pay the way to address the demands for enhanced channel capacity and system integration in future 6G communication systems.

Technical Sessions

D4-PM-A12: Micro/Nanofabrication Techniques and Devices

13:30-15:10, April 20, 2026 **Convention Hall C**

Session Chair: Hao Jia, State Key Laboratory of Transducer Technology, Shanghai Institute of Microsystem and Information Technology, CAS

Invited Speaker

13:30-13:50 **Wei Li**

Nanjing University of Posts and Telecommunications

Bio: Wei Li received his B.S. in Mechanical Engineering from Huazhong University of Science and Technology (2008) and Ph.D. in Mechanical Engineering from Michigan State University, USA (2017). From 2017 to 2020, he worked as a Postdoctoral Scholar in the Department of Electrical Engineering and Computer Sciences, and Berkeley Sensor & Actuator Center (BSAC) at the University of California, Berkeley, USA, and as an Affiliate Postdoctoral Fellow at the Lawrence Berkeley National Laboratory (LBNL), USA. In 2020, he was appointed as a tenure-track assistant professor of the College of Engineering and Mathematical Sciences at the University of Vermont, USA, where he founded and directed the UVM microsystems Laboratory. Currently, he is a Professor with the School of Integrated Circuit Science and Engineering at the Nanjing University of Posts and Telecommunications, China. He is also an Adjunct Professor at Huazhong University of Science and Technology, and State Key Laboratory of Flexible Electronics.

Dr. Li's research interests include microelectromechanical systems (MEMS), robotics and mechatronics. His papers have been published in Nature Communications, Cell Reports Physical Science, Nano Energy, Energy, Advanced Functional Materials, IEEE/ASME Transactions on Mechatronics, IEEE-ICRA, IEEE-MEMS, ACS Applied Materials & Interfaces, etc.

Title: Controlled Ion-Propelled Flying Microrobot

Abstract: Ion propulsion holds unique potential for silent, solid-state flight in microrobots, yet challenges in thrust efficiency, control, and scalable fabrication have hindered widespread adoption. This talk present the controllable flight of an ultralight (36.7 mg) ion-propelled microrobot with integrated sensing, achieving a record 5:1 thrust-to-weight ratio and 60-minute long-endurance hovering without mechanical actuators. Leveraging an origami-inspired design with cost-effective, high-performance metal-polymer composites, our manufacturing approach enables rapid, simple assembly, overcoming a critical barrier to swarm deployment. The robust payload capacity supports diverse onboard sensors, including an Inertial Measurement Unit, high-definition camera, and Fiber Bragg Grating sensor, facilitating trajectory tracking, imaging, and material detection. This work introduces a new approach to autonomous microrobotic swarm flight, opening opportunities for confined-space surveillance, disaster rescue, and exploration.

Invited Speaker

13:50-14:10

Xueqiang Zhang

Beijing Institute of Technology

Bio: Xueqiang Zhang is a Professor at the Laser Micro/Nano Fabrication Laboratory, Department of Mechanical Engineering, Beijing Institute of Technology, and a recipient of the Overseas Young Talent Program. His research centers on ultrafast laser micro/nano fabrication, processing of metastable nanomaterials, and ultrafast in-situ surface/interface characterization. He employs ultrafast lasers to generate metastable nanostructures and study their dynamics for energy conversion mechanisms; develops inert/vacuum laser processing systems across diverse timescales and pressure regimes; establishes maskless ultrafast laser fabrication for air-sensitive materials; and designs ultrafast near-ambient-pressure photoelectron spectroscopy to investigate ultrafast physicochemical processes. He has published 65 papers (47 as first or corresponding author) and holds 8 patents. He leads projects funded by NSFC Youth/General Programs, National Key R&D Program, and defense-related initiatives. He serves as a young editorial board member for Chinese Journal of Lasers (“Frontier Laser Manufacturing”) and InfoMat.

Title: Maskless Micro/nano Fabrication by Femtosecond Lasers Under Inert Atmosphere

Abstract: Femtosecond lasers serve as a novel maskless micro/nano fabrication tool, delivering unique nonlinear processing mechanisms through ultrafast, ultrashort pulses with extreme peak intensity. This enables broad material universality and offers a promising route to precision manufacturing of challenging materials. In ambient air, ablation plumes readily react with oxygen (e.g., forming SiO_2), resulting in extensive redeposition of oxide particles that severely degrade surface cleanliness, amplify interface defects in semiconductors, reduce channel mobility, and compromise device reliability. Processing in vacuum or inert atmospheres (e.g., high-purity N_2 or Ar) effectively suppresses oxidation and redeposition, mitigates thermal accumulation, and yields cleaner, lower-damage microstructures. Moreover, inert environments can shift the material removal mechanism from thermal-dominated to non-thermal processes (Coulomb explosion, multiphoton ionization), enabling finer and more controllable fabrication. This work demonstrates the superior precision machining of flexible metal electrodes, diamond, SiC, glass, and other hard/brittle or heterogeneous materials under inert atmospheres, systematically analyzes the influence of atmosphere on surface quality, morphology, removal mechanisms, and damage suppression, and explores the potential for applications in advanced semiconductors, power electronics, flexible electronics, and hard-material micro/nano manufacturing.

Invited Speaker

14:10-14:30

Yang Liu

Beijing Institute of Technology; Chongqing Innovation Center, Beijing Institute of Technology; Xi'an Institute of Electromechanical Information Technology

Bio: Yang LIU is currently an Assistant Professor in the School of Mechatronics at Beijing Institute of Technology (BIT). He received his Ph.D. in Microsystems and Microelectronics from the École Polytechnique Fédérale de Lausanne (EPFL). He has been selected as a national-level high-level young talent. His research focuses on microsystem sensing and control, encompassing multi-parameter sensing, thermoelectric conversion and thermal analysis, as well as MEMS and microfluidic actuators. His work is dedicated to constructing miniaturized integrated systems that encompass sensing, information analysis and decision-making, to execution. He has led several national-level research projects, including a grant from the NSFC Young Scientists Fund and multiple defense-related programs. He has published 15 SCI-indexed papers in prestigious journals such as Microsystems & Nanoengineering and Lab on a Chip, and holds 4 authorized invention patents.

Title: Thermoelectric Generators: From Energy Conversion to High-Sensitivity Heat Flux Sensing

Abstract: Thermoelectric effects are traditionally explored for power generation and power harvesting. However, their exceptional sensitivity to temperature gradients offers immense potential for high-precision heat flux sensing applications. This talk introduces our recent research on leveraging Bismuth Telluride (Bi2Te3) thermoelectric generator as high-performance heat flux sensors. We first present a calorimetric microflow sensor utilizing a back-side integrated thermopile probe. By converting flow-induced thermal field shifts into measurable voltage differences, the device achieves considerable sensitivity in order to measure the flow rate, providing robustness in complex or corrosive media as well. Furthermore, we demonstrate a high-throughput chip-calorimeter platform employing patterned thermopile arrays for the real-time monitoring of bacterial metabolic heat flux. This technology enables rapid antimicrobial susceptibility testing with high fidelity to clinical standards. By shifting the focus from energy harvesting to high-resolution sensing, these advancements showcase the transformative potential of thermoelectric conversion in developing miniaturized diagnostic tools and intelligent industrial monitoring systems.

Invited Speaker

14:30-14:50

Yuan Huang

Beijing Institute of Technology

Bio: Yuan Huang, Professor, PhD Supervisor, Institute of Frontier Interdisciplinary Sciences, Beijing Institute of Technology (BIT). He got PhD degree from the Institute of Physics, Chinese Academy of Sciences (IOPCAS) in 2013. He worked as a Research Associate at Brookhaven National Laboratory and Institute for Basic Science (IBS), from 2013 to 2017. He returned to China in 2017 and joined IOPCAS as an Associate Professor, then joined BIT as a Professor in 2021.

He has taken charge of more than 10 scientific research projects, including the National Key R&D Program of China (Young Scientists Project), the National Science Fund for Excellent Young Scholars, and the Outstanding Young Scholars Fund of Chongqing Municipality. He was elected a member of the Youth Innovation Promotion Association, CAS in 2019, awarded the honorary title of Top 10 Emerging Scientists in China by the China Association for Science and Technology (CAST) in 2020.

He has published more than 170 SCI-indexed papers in prestigious journals including Nature, Nature Materials, Physical Review Letters and Advanced Materials, with the total citations exceeding 10,000 and an H-index of 43. He also holds more than 10 authorized patents. Currently, he serves as an Associate Editor of InfoScience and Applied Physics Review.

Title: Dimensional Regulation and Physical Properties of Two-Dimensional Materials

Abstract: Two-dimensional (2D) materials exhibit exceptional electrical, optical, mechanical and other physical properties, which not only hold great application potential in next-generation information and electronic devices, but also provide a new platform for interdisciplinary scientific research. In our research over the past few years, we have developed a universal exfoliation technique for 2D materials, designed specialized exfoliation equipment, and identified several intriguing interdisciplinary scientific issues in the course of investigating the dimensional regulation of 2D materials. This presentation mainly covers the following aspects: (1) We have developed a quasi-dry transfer technique based on water vapor molecular intercalation, which has enabled the successful fabrication of 2D twisted structures with ultra-clean interfaces and high-performance devices. On this basis, we have established a method for the reversible regulation of the wettability of superhydrophobic plant leaves, and pointed out the long-standing misconception that the superhydrophobicity of the surfaces of plants such as lotus leaves and reeds is dominated by micro-nanostructures. (2) A significant enhancement of optical properties, including fluorescence, second harmonic generation and low-frequency vibrational modes, has been observed in suspended 2D structures. (3) We have realized the fabrication of graphene nanoscrolls and observed complex interlayer coupling modes; furthermore, on-chip polarized light sources have been fabricated based on graphene nanoscrolls.

Invited Speaker

14:50-15:10

Bowen Ji

Northwestern Polytechnical University

Bio: Bowen Ji is currently an associate professor at School of Artificial Intelligence of Northwestern Polytechnical University, China. From 2016-2018, He was jointly trained as a Ph.D. at Northwestern University under supervision of Prof. Yonggang Huang. His research focuses on the design and fabrication of implantable/wearable brain-computer interface (BCI) sensors and microsystems. He is an IEEE Senior Member, with 70+ SCI papers published (Citation 4100+), including Science, Nature, Nature Medicine, and Nature Biomedical Engineering, and 34 patents authorized. He is an associate editor for IEEE Sensors Journal, young editor for Microsystems & Nanoengineering, The Innovation, Cyborg and Bionic Systems, Soft Science, etc. He is also a TPC member for IEEE MEMS 2024-2026. In recent years, he has developed several medical-level minimally invasive BCI electrodes.

Title: Minimally Invasive Implantable Flexible BCI Sensors

Abstract: As a front-end sensor for neural signal acquisition and neural modulation, the flexible electrode is one of the core basic devices of brain-computer interface technology. Among them, the minimally invasive brain-computer interface sensor is attached to the epidural or subdural area, without damage to the brain tissue, thus, it shows high implantation safety, and the technical path is easier to be practiced and applied in the medical field. More and more attention has been paid to electrodes that are more flexible and suitable for the mechanical properties of neural tissue, and new challenges have been raised in the fine micro-nano processing and long-term service in vivo. In recent years, we have enabled the realization of a series of key design and manufacturing technologies of advanced flexible brain-computer interface sensors with neural monitoring and regulation abilities, achieving significant advantages such as soft mechanical properties, minimally invasive implantation process, reliable multi-mode integration, long-term stability in vivo, etc. It has advanced the understanding and treatment of neurological diseases.

D4-PM-B01: Micro Biosensing and Micro Manipulation

16:00-18:00, April 20, 2026 **Meeting Room 301A**

Session Chair: Yanwei Jia, University of Macau

Invited Speaker

16:00-16:20

Xing Cheng

Southern University of Science and Technology

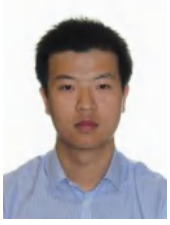
Bio: Xing Cheng received his Ph.D. in Electrical Engineering from the University of Michigan in 2005. He previously served as Assistant Professor and Associate Professor in the Department of Electrical and Computer Engineering at Texas A&M University. Since 2013, he has been a Professor in the Department of Materials Science and Engineering at the Southern University of Science and Technology (SUSTech), and was appointed Executive Dean of SUSTech's School of Semiconductor (National Graduate College of Engineers) in 2024. His research and teaching focus on semiconductor materials, devices, and micro/nanofabrication, with expertise spanning semiconductor lithography, nanomanufacturing, microfluidic chips, and MEMS sensors.

Title: A Digital Microfluidic Platform With Integrated Electrochemical Sensing

Abstract: Digital Microfluidics (DMF) enables precise electrode-driven manipulation of microliter-to-nanoliter droplets, automating analytical workflows and holding great potential for biochemical analysis and high-throughput screening. However, conventional DMF chips lack high-performance detection modules, making them incomplete micro-total analysis systems (μTAS). This work develops an integrated DMF platform with electrochemical detection capability. We report the design, fabrication, and characterization of the chip. For application, we demonstrate reliable on-chip enzymatic hydrolysis, separation, and real-time detection of lactose. This integrated platform realizes full workflow automation and in-situ detection, providing a solid hardware foundation for automated biochemical analysis such as glycan sequencing.

Invited Speaker

16:20-16:40



Shuailong Zhang

Beijing Institute of Technology

Bio: Shuailong Zhang is a full professor with Beijing Institute of Technology, China and a PhD supervisor with the same Institution. He was selected for the "National Young Talent Abroad" program in 2019. Prof. Zhang's research covers micromanipulation technologies, optical control and actuation technologies, micro total analysis system and lab-on-a-chip technologies. In 2015, he obtained a PhD degree in Physics from the University of Strathclyde in the United Kingdom under the supervision of Professor Martin Dawson, a

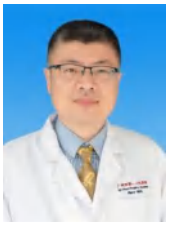
Fellow of the Royal Society. Following this, he conducted postdoctoral research in the teams of Professor Jonathan Cooper, a Fellow of the Royal Academy of Engineering, and Professor Aaron Wheeler, the Editor-in-Chief of the journal Lab on a Chip and a Tier 1 Canada research chair. Prof. Zhang has published over 100 papers in SCI journals. As a project leader and key participant, Prof. Zhang has led or participated in multiple research projects funded by the National Natural Science Foundation of China, the Key Research and Development Program of the Ministry of Science and Technology of China, the Natural Sciences and Engineering Research Council of Canada (NSERC), and the Engineering and Physical Sciences Research Council (EPSRC) of the United Kingdom.

Title: Optoelectronic Tweezers and Digital Microfluidics: A Story of Two Useful Micromanipulation Technologies

Abstract: Optoelectronic tweezers (OET) are a useful opto-electro-fluidic technology utilizing light-patterned dielectrophoresis for fine and non-invasive control and actuation of micro-objects. The first part of this presentation demonstrated the use of OET to manipulate different objects, including microrobots, micromachines and biological cells. The second part of the presentation introduces another complementary technology known as digital microfluidics (DMF), which utilizes electrowetting-on-dielectric effect to move tiny droplets. DMF is very useful for applications such as point-of-care diagnostics, single-cell analysis, and sample preparation for Mass Spectroscopy and Nuclear Magnetic Resonance Spectroscopy. The experimental results demonstrated that OET and DMF are very useful micromanipulations tools for chemistry, physics, and biomedical engineering.

Invited Speaker

16:40-17:00



Dayu Liu

The Second Affiliated Hospital, South China University of Technology

Bio: Dr. Dayu Liu is a professor at the Second Affiliated Hospital of South China University of Technology (SCUT). He obtained his Bachelor of Clinical Medicine from Dalian Medical University in 1995 and received a Ph.D. in Analytical Chemistry from the University of Chinese Academy of Sciences (UCAS) in 2005. Dr. Liu conducted postdoctoral research at the Hong Kong University of Science and Technology (HKUST) from 2011 to 2012. Currently, he serves as the Director of the Guangdong Provincial Engineering Research Center for Microfluidic Chip Medical Diagnostics. With a multidisciplinary academic background, Dr. Liu’s research primarily focuses on advancing microfluidic technologies for in vitro diagnostic applications. His work emphasizes the development of microfluidic chip-based rapid and high-content diagnostic platforms targeting infectious diseases and cancer. To date, he has published over 50 articles in peer-reviewed journals and is the Principal Investigator for 6 General Program grants awarded by the National Natural Science Foundation of China (NSFC). Furthermore, Dr. Liu holds more than 20 granted invention patents in China.

Title: Development of Digital Microfluidics Droplet Inlet/Outlet Interface Technology and Its Application in In Vitro Diagnostics

Abstract: Digital microfluidics (DMF) represents a liquid manipulation technology that leverages the electrowetting-on-dielectric (EWOD) phenomenon, wherein the application of an electric voltage alters the contact angle of droplets on a hydrophobic surface. This technology allows programmable liquid manipulations such as dispensing, transporting, merging, and splitting within volumes ranging from nanoliters to microliters, thereby offering a theoretically optimal platform for on-demand sample processing. However, conventional DMF devices are subject to intrinsic limitations: the narrow gap between plates restricts fluidic exchange with external systems, substantially limiting their effectiveness in facilitating on-demand nucleic acid detection. This physical constraint is especially significant when processing batch samples that necessitate continuous liquid input and output. To overcome this limitation, we have developed a series of DMF interface technologies to enable continuous droplet introduction and extraction. The advancement of these technologies has significantly enhanced the sample handling capacity and application flexibility of DMF. We demonstrate the application of DMF devices equipped with droplet introduction and extraction interfaces in in vitro diagnostics.

Invited Speaker

17:00-17:20

Ren Shen

University of Macau

Bio: Dr. Ren Shen is currently an Assistant Professor at the Institute of Microelectronics, University of Macau. She obtained her B.Sc. in Biology from Tsinghua University in 2011 and her Ph.D. in Electrical and Computer Engineering from the University of Macau in 2021, followed by postdoctoral training at the University of Macau and Hong Kong Polytechnic University. With a multidisciplinary background, Dr. Shen is interested in applying engineering tools to solve biomedical and environmental problems. Her research focuses on the development of biosensors, digital microfluidic technologies, and lab-on-a-chip systems. To date, she has published over 10 peer-reviewed journal papers and received several best-poster awards at international conferences. Dr. Shen also has extensive experience in industry-academia-research collaboration and technology transfer, with five U.S. and Chinese invention patents filed to date, four of which have been granted.

Title: Field-deployable Systems for On-site Nucleic Acid Analysis Based on Digital Microfluidics

Abstract: Nucleic acids have been an important source for exploring various aspects of our lives, including public health, food safety, and environmental inspection. Since on-site analysis is often required in real-world applications, field-deployable systems with easy-to-perform analytical methods and portable devices are highly desirable. In this talk, I will introduce efforts to develop microfluidic-based systems for nucleic acid analysis and how we tailor them for field applications. I will present experimental efforts and results on enhancing the robustness of chip-based reactions, obtaining naked-eye visible signals, achieving fast on-chip reactions, and reducing the total cost per test. The applications of such

systems, including a yes-or-no identification of pathogens and further discrimination of gene mutations, will also be discussed.

Invited Speaker

17:20-17:40

Wenhao Hui

Zhuhai ProMed Precise Medical Technology Co., Ltd.

Bio: Wenhao Hui is the CEO and co-founder of ProMed Precise Medical Technology Co., Ltd., and also serves as a councilmember in Hengqin Health and Biomedicine Industry Association. He obtained his Ph.D. from the State-Key Laboratory of Analog and Mixed-Signal VLSI, University of Macau, followed by a visiting scholar at Imperial College London. His research activities span over single-cell impedance sensing CMOS, digital microfluidics, and large-scale patterning techniques on chips, aimed at clinical diagnosis of primary tumors and drug screening applications. Dr. Hui has authored multiple publications in leading journals such as the Advanced Science、ACS Sensors, Sensors and Actuators B et al, with two papers featured as cover stories. His work was recognized with the IEEE Biosensors2024 Best Paper Award. Leveraging years of practical experience in the In Vitro Diagnostics medical device, he has incubated two medical device companies. The detection chips and instruments developed have been successfully deployed in hospitals in China, England and the United States.

Title: Commercialization of Digital Microfluidics Precision Medicine Platform

Abstract: Digital microfluidics (DMF) is widely used in biomedical research, diagnostics, chemistry, and chemical synthesis for its precision in manipulating discrete droplets. In this talk, I will introduce the implementation of automated sample delivery, splitting, mixing, concentration control, and analysis on DMF. I will present applications of the intelligent DMF platforms in primary tumor drug screening, antibiotic susceptibility test, and polymerase chain reaction test and discuss how to establish a clinical protocol for precision medicine and commercialization. Future prospects and market potential of the DMF-based precision medical platform will be discussed.

Invited Speaker

17:40-18:00

Ning Yang

Jiangsu University

Bio: Yang Ning, Professor and Doctoral Supervisor at Jiangsu University, Vice Dean of the School of Integrated Circuits. Selected for the National Key R&D Program for Young Chief Scientists, Jiangsu Province Excellent Youth, Jiangsu Province 333 Project Second level Talents, Shennong Young Talents and other talent programs. Currently serving as the Vice President of Science and Technology at Jiangsu Changdian Technology, as well as a member and Deputy Secretary General of several national level societies, and serving as the Deputy Editor in Chief of Frontiers in Plant Science and the Editor in Chief of the

Biosensors column. Hosted over 10 national and provincial-level projects, including the National Key Research and Development Program and the National Natural Science Foundation of China; As the first/corresponding author, I have published over 50 papers in first tier/TOP journals such as Science Advances, authored 2 monographs, edited/co edited multiple standards and textbooks, and obtained over 30 national invention patents and 2 international patents. Received honors such as the Second Prize of Science and Technology in Jiangsu Province (first author) and the First Prize of China Industry University Research Cooperation Innovation Achievement.

Title: AI-Driven Biological Information Perception: Principles and Applications

Abstract: By integrating optical diffraction imaging, impedance sensing, and MEMS technology, a multimodal intelligent detection system has been constructed, achieving a series of breakthroughs in the field of rapid detection of pathogenic microorganisms. Lens free diffraction imaging achieves 96% virus recognition accuracy, microfluidic impedance sensor has a detection limit of 188 TCID50/mL for African swine fever virus, and MEMS integrated platform achieves 95.99% aerosol pathogen separation efficiency. This technology provides an efficient and low-cost solution for disease diagnosis and biosafety.

Technical Sessions

D4-PM-B02: Micro/Nano Electro-Mechanical Systems (M/NEMS)

16:00-18:15, April 20, 2026 **Meeting Room 301B**

Session Chair: Guochang Liu, Tsinghua University

16:00-16:15	**Paper ID:** Oral# 333 **Paper Title:** Piezoelectric Energy Harvesting Powered Wireless Sensor for Lathe Tool Vibration **Presenter:** Yanpu Yao, Xi'an Jiaotong University
16:15-16:30	**Paper ID:** Oral# 335 **Paper Title:** High-Performance Cross-Field-Excited Piezoelectric Micromachined Ultrasonic Transducer Based on X-cut Lithium Niobate Thin Film **Presenter:** Jialin Long, University of Science and Technology of China
16:30-16:45	**Paper ID:** Oral# 342 **Paper Title:** Motion-Artifact-Suppressed Pulse Wave Monitoring Based on an Iontronic Pressure Sensor **Presenter:** Shaoqi Tang, Shenzhen Technology University
16:45-17:00	**Paper ID:** Oral# 370 **Paper Title:** Near-Zero-Power Passive Magnetoelectric Resonant Sensor Based on Ultrathin AlScN/FeGaB Bilayer for High-Resolution AC Magnetic Field Detection **Presenter:** Haoqi Lyu, Aerospace Information Research Institute, Chinese Academy of Sciences
17:00-17:15	**Paper ID:** Oral# 373 **Paper Title:** A Wearable sEMG – PMUT Sensor Fusion Approach for Hand Gesture Recognition Based on Machine Learning **Presenter:** Wenhe Yang, Zhejiang University
17:15-17:30	**Paper ID:** Oral# 376 **Paper Title:** A Composite Cantilever Accelerometer for Hydraulic Pipeline Vibration Monitoring and Intelligent Identification **Presenter:** Wenzhe Bi, Xi'an Jiaotong University
17:30-17:45	**Paper ID:** Oral# 379 **Paper Title:** Development of Right-angled Trapezoidal Multimodal Piezoelectric Micro-Mechanical Ultrasonic Transducer **Presenter:** Yali Zhang, Yangtze University
17:45-18:00	**Paper ID:** Oral# 418 **Paper Title:** Bionic Super-Resolution Electronic Skin for Haptic Enhancement in Robotics **Presenter:** Jingyan Zhang, Peking university
18:00-18:15	**Paper ID:** Oral# 422 **Paper Title:** Design of a SpinCilium MEMS Vector Hydrophone Driven by the COBYLA Algorithm **Presenter:** Zhengyu Bai, North University of China

D4-PM-B03: Micro Biosensing and Micro Manipulation & Milli Micro and Nano Robotics

16:00-17:20, April 20, 2026 **Meeting Room 301C**

Session Chair: Yichuan Wu, University of Electronic Science and Technology of China

Invited Speaker

16:00-16:20

Yongliang Yang

Shenyang Institute of Automation, Chinese Academy of Sciences

Bio: Dr. Yongliang Yang received his B.S. degree in Mechanical Engineering from Harbin Engineering University, Harbin, China, in 2005 and his Master and Ph.D. in Mechanical Engineering from the University of Arizona, Tucson, the United States in 2012 and 2014 respectively. Prior to joining SIA, he was a postdoc in Michigan State University during 2014 and 2021. He has been a professor in State Key Laboratory of Robotics at Shenyang Institute of Automation (SIA), Chinese Academy of Sciences since 2021. He is also a Guest Professor at The Army Medical University, a Youth Editor of Chinese journal "Information and Control", and Member of Robotics Branch of Chinese Institute of Electronics. His current research interests include self-organized systems in biology and robotics, computational biology and optics.

Title: MorphoSystem: A Platform Integrating Cell Collectives and Robot Swarms

Abstract: Understanding how physical mechanisms drive collective cellular behavior is a central challenge in mechanobiology. Current methodologies are limited by either the inaccuracy of computational simulations or the poor controllability of in vitro models. We introduce MorphoSystem, a bio-hybrid platform that integrates robot swarms and computational modeling with cell collectives to study developmental processes. By bridging biological realism with engineering precision, MorphoSystem offers a scalable, quantitatively tractable framework for investigating the physical principles of morphogenesis. This interdisciplinary approach not only advances our understanding of developmental biology but also provides a blueprint for the design of adaptive robotic swarms.

Invited Speaker

16:20-16:40

Mojun Chen

Hong Kong University of Science and Technology (Guangzhou)

Bio: Mojun Chen, Assistant Professor in the Smart Manufacturing Thrust at the Hong Kong University of Science and Technology (Guangzhou). He obtained his PhD and conducted postdoctoral research at the University of Hong Kong. His research interests include micro/nano 3D printing technology, optoelectronic devices, micro/nano robots, and wearable devices. He has published ~30 papers (including 4 cover papers) in top journals such as Advanced Materials (front cover), Nano Letters, ACS Nano, Advanced

Functional Materials, and Small (frontispiece), and has been granted 2 China-US patents. He is a recipient of the Ministry of Education's U40 Program, and serves as the project leader for the "14th Five-Year Plan" National Key R&D Program. He also oversees a research project funded by the National Natural Science Foundation of China, in addition to leading multiple initiatives supported by the Natural Science Foundation of Guangdong Province, various municipal-level funding bodies, and collaborative projects with industry partners and research institutions. He serves as a Young Editorial Board Member of eScience (Impact Factor: 42.9)

Title: 3D-Printed E-Skin: A Wearable Platform for Plant Growth Monitoring

Abstract: Continuous and precise monitoring of plant growth is critical for advancing global smart agriculture, as it plays a pivotal role in mitigating food shortages and ensuring optimal crop quality. Currently, existing plant growth monitoring instruments are plagued by several unresolved challenges, including low measurement precision, invasive damage to plants, and limited light transmittance—all of which hinder normal photosynthetic processes and compromise monitoring reliability. Herein, we report an ultrasensitive liquid metal e-skin (LMES) specifically designed for non-invasive, high-precision plant growth monitoring. The LMES was fabricated via direct ink writing (DIW), wherein gallium-indium eutectic alloy (EGaIn) ink was extruded through micro-nozzles with modified inner surfaces onto a flexible substrate, forming a stretchable strain sensor with integrated sensing capabilities. This LMES exhibits superior performance, including ultrahigh sensitivity, rapid response time, excellent long-term stability, and high optical transmittance—key advantages that address the limitations of conventional monitoring tools. To validate its practical applicability, continuous growth monitoring was conducted on Golden pothos leaves; results demonstrated that the LMES could precisely capture leaf growth cycles under photosynthetic conditions and distinguish varying growth rates across different leaf ages, enabling microscale non-invasive monitoring of plant growth dynamics. Collectively, these findings confirm the feasibility and practical potential of the LMES, offering a novel, high-performance sensing platform for advancing smart agriculture technologies

Invited Speaker

16:40-17:00

Yichuan Wu

University of Electronic Science and Technology of China

Bio: Yichuan Wu received his B.S. degree in Mechanical Engineering from China Agricultural University in 2013 and his Ph.D. degree in Mechanical Engineering from Tsinghua University in 2019. From 2016 to 2018, he was a visiting researcher at the University of California, Berkeley. He is currently an Associate Professor at the University of Electronic Science and Technology of China. His research focuses on insect-scale robotics, with an emphasis on bio-inspired design, actuation, and control of untethered microrobots. He has published research papers in Science Robotics, Nature Communications, IEEE MEMS, and IEEE Transducers.

Title: Untethered Soft Millirobots

Abstract: Cockroaches are well known for their ability to rapidly traverse confined spaces and maintain stable locomotion under strong impacts, owing to their highly controllable gait and flexible exoskeletal structure. Replicating these characteristics in untethered microrobots (with a mass of ~1 g) has long been a significant challenge. Current microrobots typically rely on multiple actuators to achieve tunable leg motions for controlled locomotion; however, such designs often result in bulky structures, larger size, increased stiffness, and higher system complexity, which compromise their agility and impact resistance. In this work, we propose a design that enables controllable, multi-directional leg motions using only a single actuator. This approach provides new insights and guidance for the development of controllable and resilient microrobots.

Invited Speaker

17:00-17:20

Tianliang Li

Wuhan University of Technology

Bio: Tianliang Li is currently a Full Professor with Wuhan University of Technology (WHUT), China. Dr. Li received the M.S and Ph.D. degree from WHUT, in 2014 and 2016, respectively. After obtaining his Ph.D., he worked as a Research Fellow at Nanyang Technological University and the National University of Singapore. His research interests include advanced optical fiber sensing and embodied intelligent surgical robots. He has authored more than 100 papers in international journals and conferences.

Title: Fiber-Optic Multimodal Sensing-based Flexible Surgical Robots

Abstract: For precise minimally invasive interventions in complex luminal and confined surgical spaces, flexible surgical robots are becoming an important frontier in the development of advanced medical devices. The real-time and accurate acquisition of the interaction state between intraoperative end-effectors and biological tissues is directly related to surgical safety, operational accuracy, and the level of intelligent functionality. However, under multiple constraints, including limited distal-end space, preoperative high-temperature sterilization, and intraoperative high-humidity thermal environments, existing sensing approaches still struggle to simultaneously achieve dexterous integration, long-term stability, and synchronous acquisition of multimodal information, thereby creating an urgent need for more reliable in situ sensing methods. In response, this report highlights our recent advances in suspended embedded fiber-optic sensing configurations, mechano-optical decoupling of multidimensional force and temperature information, narrow-zone packaging of metallized optical fibers and co-integrated fabrication with end-effectors, as well as redundant and fault-tolerant measurement based on composite sensing units, and demonstrates their applications in flexible surgical robots for spinal endoscopy and transnasal endoscopy.

Technical Sessions

D4-PM-B04: Nano Photonics and Micro/Molecular Optical Devices

16:00-17:45, April 20, 2026 **Meeting Room 302A**

Session Chair: Johnny Wong, Elsevier (Cell Press)

16:00-16:15	**Paper ID:** Oral# 75 **Paper Title:** High-Sensitivity Refractive Index Sensor Based on Bound States in the Continuum **Presenter:** Wenxin Zhu, University of Electronic Science and Technology of China
16:15-16:30	**Paper ID:** Oral# 89 **Paper Title:** A Multifunctional High-Q Chiral Metasurface for Polarization Manipulation Enabled by Vertical Symmetry Breaking **Presenter:** Cunjing Liu, University of Electronic Science and Technology of China
16:30-16:45	**Paper ID:** Oral# 168 **Paper Title:** Low-Cost Large-Scale Perovskite-Based 3D Optical Chiral Metamaterials with Azimuth-Dependent Strong Circular Dichroism Sign Reversal **Presenter:** Yifan Zeng, North China Electric Power University
16:45-17:00	**Paper ID:** Oral# 196 **Paper Title:** Laser Phase-Shifting Interferometry for Micro-Scale Displacement Measurement of Piezoelectric Actuators **Presenter:** Yuxuan Xing, The Australian National University
17:00-17:15	**Paper ID:** Oral# 238 **Paper Title:** Stacked Nanograting Optical Resonators Fabricated Through Cascading Ion Beam Etching Processes **Presenter:** Fangming Sheng, Shanghai Jiao Tong university
17:15-17:30	**Paper ID:** Oral# 255 **Paper Title:** Grain Boundary: A Decisive Constraint In Integrated-Back-Contact Perovskite Solar Cells **Presenter:** Menglei Mao, Beijing Institute of Technology
17:30-17:45	**Paper ID:** Oral# 362 **Paper Title:** Low-Loss Ferroelectric Electro-Optic Waveguide Modulator Using Remnant Polarization Doped Graphene Electrodes **Presenter:** Tianran Shi, University of Science and Technology of China

Technical Sessions

D4-PM-B05: Micro/Nano/Molecular Physical/Chemical Sensors/Actuators

16:00-17:30, April 20, 2026 **Meeting Room 302B**

Session Chair: Weijin Guo, Shantou University

16:00-16:15	**Paper ID:** Oral# 329 **Paper Title:** Investigation of temperature coefficient of frequency of SAW device on ε-Ga_2O_3/Mo/Sapphire structure **Presenter:** Peng Huang, Wuhan Textile University
16:15-16:30	**Paper ID:** Oral# 337 **Paper Title:** Machine Learning-Driven Colorimetric Sensing and Monitoring of Optically-engineered Liquid Marbles **Presenter:** Jing Jin, Harbin Institute of Technology, Shenzhen
16:30-16:45	**Paper ID:** Oral# 359 **Paper Title:** Influence and Modulation of Adsorption State of Analyte Molecules on SERS Enhancement **Presenter:** Zhaocheng Shao, North China University of Technology
16:45-17:00	**Paper ID:** Oral# 409 **Paper Title:** Crack-Encoded Tactile Sensors with Mechanical Decoupling for Multiscale Tactile Fusion in Robotics **Presenter:** Lang Wang, Westlake University
17:00-17:15	**Paper ID:** Oral# 413 **Paper Title:** A Soft, Load-Insensitive Young's Modulus Sensor for Wearable, Real-Time Muscle Activity Monitoring **Presenter:** Yiran Wang, Peking University
17:15-17:30	**Paper ID:** Oral# 414 **Paper Title:** Dissipative Love-Wave Acoustic Sensing for Real-Time Monitoring of Blood Viscoelasticity During Coagulation **Presenter:** Shuang Yu, Dalian University of Technology

Technical Sessions

D4-PM-B06: Micro/Nano Energy Devices and Self-Powered Systems

16:00-17:30, April 20, 2026 **Meeting Room 305**

Session Chair: Jinkai Chen, Hangzhou Dianzi University

16:00-16:15	**Paper ID:** Oral# 41 **Paper Title:** RF Oscillator-Based Self-Powered Instantaneous Wireless Sensing System for Environmental Monitoring and Wearable Applications **Presenter:** Jinkai Chen, Hangzhou Dianzi University
16:15-16:30	**Paper ID:** Oral# 151 **Paper Title:** Low-Temperature Resistant and Biodegradable Triboelectric Sensing System with High Dielectric Electrospun Films for Intelligent Wheelchair Curling Monitoring **Presenter:** Yupeng Mao, Northeastern University
16:30-16:45	**Paper ID:** Oral# 225 **Paper Title:** Wearable Nano-Electronics with Improved Stress Transfer Interfaces for Accurate Pulse Wave Monitoring **Presenter:** Hao Lei, Soochow University
16:45-17:00	**Paper ID:** Oral# 230 **Paper Title:** Mechanical-Optical-Electrical Coupled Energy Conversion in Liquid-Solid Triboelectric Nanogenerators **Presenter:** Xiya Yang, Jinan University
17:00-17:15	**Paper ID:** Oral# 174 **Paper Title:** MEMS Tunable Metamaterial with Equivalent Binary Digits in Multi-functional Opto-logic Applications **Presenter:** Jiahao Li, The University of Tokyo
17:15-17:30	**Paper ID:** Oral# 14 **Paper Title:** Plaque-on-a-Chip: A Novel Perfusable 3D Vascular Model to Study Endothelial and Smooth Muscle Cells Dysfunction in Atherosclerosis **Presenter:** Hui Min Tay, Nanyang Technological University
17:30-17:45	**Paper ID:** Oral# 411 **Paper Title:** Design, Simulation and Verification of Cooling System for Lithium-Ion Battery Packs in Energy Storage Systems **Presenter:** Mohammed Ali Othman Esmail Othman, Sichuan University

Technical Sessions

D4-PM-B07: Micro/Nano – Composite Materials and Structures

16:00-17:30, April 20, 2026 **Meeting Room 306**

Session Chair: Xiangmeng Li, North University of China

16:00-16:15	**Paper ID:** Oral# 51 **Paper Title:** Flexible Multimodal Sensor Based on Micro-Porous Composite Silicone Rubber Conductive Film **Presenter:** Changliu He, University of Electronic Science and Technology of China
16:15-16:30	**Paper ID:** Oral# 52 **Paper Title:** Investigation of Ionic-Electronic Coupling Effect of Wood-Derived Nanogenerators **Presenter:** Xu Zeng, University of Electronic Science and Technology of China
16:30-16:45	**Paper ID:** Oral# 56 **Paper Title:** Mechanistic Investigation into Pyrolysis-Induced Failure Phenomena in Silicon-based Lead Zirconate Titanate (PZT) Thin Films **Presenter:** Xinyu Zhang, Xi'an Jiaotong University
16:45-17:00	**Paper ID:** Oral# 202 **Paper Title:** Porous Sandwich-Like Structured Composite Film for Electromagnetic Interference Shielding **Presenter:** Peiwei Li, North University of China
17:00-17:15	**Paper ID:** Oral# 221 **Paper Title:** High Temperature Decay Mechanism of All Solid-State Thin-Film Li-ion Battery **Presenter:** Ziyu Zhao, Southeast University

Technical Sessions

D4-PM-B08: Biomimetic Microelectromechanical Systems (MEMS) Technology & 3D Printing and Bioprinting

16:00-18:15, April 20, 2026 **Meeting Room 307**

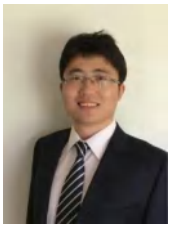
Session Chair: Renxin Wang, North University of China

Invited Speaker

16:00-16:20

Mengxi Wu

Dalian University of Technology



Bio: Prof. Mengxi Wu received his bachelor and master's degrees in Microelectronics from Peking University and received his Ph.D. degree in Engineering Science and Mechanics from Pennsylvania State University in 2018. He served as postdoc fellow at University of Michigan from 2018 to 2020 and became a professor at Dalian University of Technology since 2021. His research interests are in the fields of acoustofluidics, flexible electronics, and micro/nano systems for biomedical diagnostics and therapeutics. He has authored/co-authored over 50 journal publications in these fields.

Title: Bio-inspired Ultra-thin Electrocorticography Electrode Array

Abstract: Electrocorticography electrode arrays (EEAs) are key brain-computer interfaces. To be capable of freestanding, which lays the foundation of fabrication and implantation, EEAs need to maintain sufficient rigidity. However, to form seamless and damage-free contact on the cerebral cortex, EEAs should be super-flexible, raising a seemingly unsolvable dilemma. Here, inspired by dragonfly wings, we present, for the first time, a freestanding submicron EEA that combines rigidity and flexibility, the two mutually exclusive characteristics. A wing vein-like frame is introduced to enable freestanding capability, meanwhile the wing membrane-like functional region of the EEA is reduced to 850-nm-thickness that boosts its softness dramatically. This bio-inspired EEA ensures excellent cortical conformality and biocompatibility on epileptic rat models, improves electrocorticographic amplitude and signal-to-noise ratio for more than one-order-of-magnitude. Our vein-membrane hybrid structure strategy resolves the inherent contradiction of EEAs, thus is poised to catalyze a new wave of advances in brain science and related fields.

Invited Speaker

16:20-16:40

Junqiu Zhang

Jilin University

Bio: Junqiu Zhang is a Professor and Doctoral Supervisor at the College of Bionic Science and Engineering, Jilin University, China. He received his Ph.D. in Engineering and was a visiting scholar at Columbia University. He is recognized as a leading talent under the Changbai Mountain Science and Technology Innovation Program (Defense Field) and holds the "Tang Aoqing Scholar" Distinguished Professorship at Jilin University. He also serves as an expert for a major thematic program of the JKW. His research is oriented toward major national strategic needs in aerospace, defense, and security, focusing on bioinspired ultra-sensitive sensing, high-efficiency energy harvesting, and advanced protective technologies for extreme environments. His work aims to bridge biological principles with engineering applications to enable high-performance and reliable systems under complex conditions. As the principal investigator, he has led 27 research projects, including those funded by the National Natural Science Foundation of China and defense-related programs. He has published over 115 SCI-indexed papers in leading journals such as Advanced Materials and Advanced Functional Materials, authored one monograph and two textbooks, and holds 88 authorized national invention patents. He has received a Gold Medal at the Geneva International Exhibition of Inventions, along with multiple provincial and ministerial-level awards.

Title: One Species, Dual Functions: A Two-Decade Research Journey

Abstract: Over the past two decades, our research has been deeply inspired by a single remarkable species: the desert scorpion. This presentation summarizes a twenty-year scientific journey that evolved from studying bionic anti-erosion to pioneering high-performance bionic sensors. Initially, we investigated how scorpions withstand severe wind-blown sand erosion. By uncovering the synergistic effects of their surface morphology, flexible connections, and tough materials, we developed highly erosion-resistant bionic surfaces.

Subsequently, discovering the scorpion's extraordinary vibration perception capabilities inspired our transition into bionic sensing. We successfully developed a series of high-performance flexible pressure sensors that address critical engineering bottlenecks. By mimicking the structure of the scorpion's pectines and slit sensilla, along with features from bladderworts, cockroaches, and water striders, we resolved the trade-offs between high sensitivity and a wide measurement range, as well as high precision and low detection thresholds. Furthermore, we achieved the decoupling of multi-dimensional force directions directly through physical structures, significantly reducing the reliance on complex algorithms. To tackle environmental adaptability, we designed moisture-resistant sensors inspired by tree frog toe pads and lotus leaves, ensuring long-term stability in highly humid conditions.

These bionic sensors have demonstrated tremendous potential in various applications, including human physiological monitoring, robotic tactile grasping, and obstacle recognition. Finally, the presentation highlights our recent efforts in establishing standardized terminology and evaluation methods for bionic

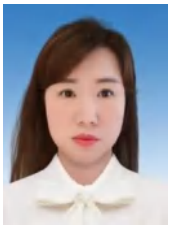
sensing technologies. By bridging the gap between biological mechanisms and engineering applications, our work provides innovative solutions for next-generation flexible electronics and intelligent perception systems.

Invited Speaker

16:40-17:00

Yunhong Liang

Jilin University



Bio: Professor Yunhong Liang is a Professor and PhD Supervisor at Jilin University, where she is affiliated with the Key Laboratory of Bionic Engineering of the Ministry of Education and serves as Deputy Director of the National International Cooperation Base for Bionic Engineering. She was also a Visiting Scholar at the University of Manchester, UK. Her research focuses on bioinspired engineering, including bionic structural design, functional materials, bioinspired sensing and actuation, 3D/4D printing, and flexible intelligent robotics. Professor Liang has received the National Science Fund for Excellent Young Scholars and has led a number of major national and provincial research projects. She has published more than 60 SCI-indexed papers, authored academic books in bionic engineering, and holds multiple invention patents. She is also actively engaged in the academic community through editorial and professional service, including roles with the Journal of Bionic Engineering, Bio-Design and Manufacturing, and the International Society of Bionic Engineering.

Title: Design and Applications of Electroactive Biomimetic Intelligent Actuation Materials

Abstract: An ion actuator is a type of electrohydrodynamic device that generates airflow and mechanical actuation through the motion of ions in an electric field. Compared with conventional actuators, ion actuators offer several unique advantages, including simple structure, no moving mechanical parts, low acoustic noise, and the potential for lightweight and miniaturized design. These features make them attractive for applications in soft robotics, flow control, thermal management, and biomimetic systems. This report presents an overview of the working principles, structural design, and performance characteristics of ion actuators. Particular attention is given to the ionization process, charge transport mechanism, electrode configuration, and the main factors influencing actuation efficiency and output performance. In addition, recent progress in materials, fabrication methods, and application scenarios is reviewed to illustrate the development trend of this technology. Although ion actuators demonstrate promising potential, several challenges remain, including limited output force, relatively high driving voltage, stability issues, and difficulties in system integration. Overall, ion actuators represent an emerging and highly promising actuation technology, with broad prospects for future development toward higher efficiency, improved safety, and wider practical implementation in intelligent engineering systems.

Oral Presentations

17:00-17:15	**Paper ID:** Oral# 26 **Paper Title:** Research on Dynamically Tunable Magnetic Metamaterial Absorbers **Presenter:** Yuming Lan, University of Electronic Science and Technology of China
17:15-17:30	**Paper ID:** Oral# 73 **Paper Title:** Design, Simulation, and Experimental Validation of a 3D-Printed Bidirectional Double-Crankshaft Energy-Harvesting Speed Bump for Vehicular Kinetic Energy Recovery **Presenter:** Abdulwasea Alothmani, Sichuan University
17:30-17:45	**Paper ID:** Oral# 97 **Paper Title:** 3D-Printed Microdevice for Ultrasound-Triggered, On-Demand Drug Release **Presenter:** Xin Ding, ShanghaiTech University
17:45-18:00	**Paper ID:** Oral# 431 **Paper Title:** Elastic Rebound Engineering via Leaf Venation Mimicry for High-Performance Droplet-Based Triboelectric Nanogenerators **Presenter:** Zhengnan Sun, University of Electronic Science and Technology of China
18:00-18:15	**Paper ID:** Oral# 432 **Paper Title:** Structurally Controlled 3D-Printed Hierarchical Carbon Electrodes **Presenter:** Xuyang Hu, University of Electronic Science and Technology of China

Technical Sessions

D4-PM-B09: Micro/Nano – Bio-/Medical Devices and Systems

16:00-17:45, April 20, 2026 **Meeting Room 308**

Session Chair: Ming Lyu, Inner Mongolia University

16:00-16:15	**Paper ID:** Oral# 94 **Paper Title:** A Study on Ultrasonic Attenuation and Skull – Brain Interface Reflection for Transcranial Neuromodulation with Low-Frequency PMUTs Devices **Presenter:** Jiangwei Yu, Xi'an Jiaotong University
16:15-16:30	**Paper ID:** Oral# 206 **Paper Title:** Wirelessly Controlled and Implantable Nitric Oxide Release System for the On-Demand Treatment of Glioblastoma **Presenter:** Ya Wang, Beijing Normal-Hong Kong Baptist University
16:30-16:45	**Paper ID:** Oral# 235 **Paper Title:** High Throughput Single Leukocytes Electro-Mechano-Phenotyping for Cardiovascular Risk Stratification in Type 2 Diabetes **Presenter:** Linwei He, Nanyang Technological University
16:45-17:00	**Paper ID:** Oral# 297 **Paper Title:** Inertial Microfluidic Separation of Microorganisms from Soil Samples using a 3D-Printed Spiral Chip **Presenter:** Zuxian Pan, Xiangfu Laboratory
17:00-17:15	**Paper ID:** Oral# 264 **Paper Title:** Closed-Loop Wearable Device Network of Intrinsically-Controlled, Bilateral Coordinated Functional Electrical Stimulation for Stroke **Presenter:** Zuxian Pan, Beijing Institute of Nanoenergy and Nanosystems
17:15-17:30	**Paper ID:** Oral# 277 **Paper Title:** Epidural Electrical Stimulation with a 16-Channel Flexible Electrode Enabled Movement in Spinal Cord Injury Rats **Presenter:** Xinkai Jing, Hainan University
17:30-17:45	**Paper ID:** Oral# 307 **Paper Title:** Bioaerosol Monitoring Workflow: Smartphone-Based Simultaneous-Multichannel Magnetoelastic Sensing for Airborne Pathogens Detection **Presenter:** Zhongyun Yuan, Taiyuan University of Technology

Technical Sessions

D4-PM-B10: Micro/Nanofabrication and Sensor

16:00-17:15, April 20, 2026 **Convention Hall A**

Session Chair: Ali Imran, National Nanotecch Innovation Center

16:00-16:15	**Paper ID:** Oral# 122 **Paper Title:** Broadband 3D Force Tactile Sensor via Rigid- Flexible Kirigami and Gradient Micro- Frustum Arrays **Presenter:** Xiangyang Song, Xiamen University
16:15-16:30	**Paper ID:** Oral# 198 **Paper Title:** CNN-Assisted Analysis of Graphene FET Biosensor Electrical Signatures for Breast Cancer Identification **Presenter:** Ziran Wang, Shandong University
16:30-16:45	**Paper ID:** Oral# 254 **Paper Title:** Structural Integrated Flapping Frequency Monitoring for Bionic Microrobotics **Presenter:** Jilong Chen, University of Electronic Science and Technology of China
16:45-17:00	**Paper ID:** Oral# 279 **Paper Title:** Adaptive Brain Computer Interfaces for Deciphering and Modulating Circuit Dynamics **Presenter:** Qianli Jia, Chinese Academy of Sciences
17:00-17:15	**Paper ID:** Oral# 71 **Paper Title:** Interfacial Self-Assembly of Permeable Flexible Biosensors for Biomarker Monitoring **Presenter:** Jianxin Zhang, Shanghai Jiao Tong University

Technical Sessions

D4-PM-B11: Radio Frequency Micro/Nanodevices & M/NEMS Resonators

16:00-18:00, April 20, 2026 **Convention Hall F**

Session Chair: Yansong Yang, Hong Kong University of Science and Technology

Invited Speaker

16:00-16:20 **Jun Xu**

Southeast University

Bio: Jun Xu (Member, IEEE) received the B.S. degree in communication engineering from Nanjing University of Science and Technology, Nanjing, China, in 2013, and the M.S. and Ph.D. degrees in electromagnetic field and microwave technology from Southeast University, Nanjing, in 2015 and 2019, respectively. Since 2022, he has been with Southeast University, where he is currently an Associate Professor with the State Key Laboratory of Millimeter Waves, School of Information Science and Engineering. He was with the Poly-Grames Research Center, Department of Electrical Engineering, Ecole Polytechnique de Montréal, University of Montreal, Montreal, QC, Canada, and the State Key Laboratory of Terahertz and Millimeter Waves, Department of Electrical Engineering, City University of Hong Kong, Hong Kong SAR, China. His current research interests include millimeter-wave and THz antennas/circuits/systems/RFICs as well as integration design techniques for future wireless communication and sensing applications. Dr. Xu received the Young Scientist Award of IEEE UCMMT in 2025, the Young Scientist Award of ACES in 2024， the Excellent Doctoral Dissertation Award of China Education Society of Electronics in 2020, and the Certification as an Outstanding Reviewer from the IEEE Antenna and Propagation Society in 2022, 2023 and 2024. He serves as a Guest Editor of IEEE Antennas and Wireless Propagation Letters and Electronics Letters, an active reviewer for multiple technical journals, the Treasurer of IEEE Nanjing Section AP-S/MTT-S/EMC-S Joint Chapter, the Mentor of IEEE MTT-S Student Branch Chapter of Southeast University, a Publication Chair for IEEE APCAP2024, UCMMT2025, and a TPC member or a session chair for several academic conferences.

Title: Millimeter-Wave Integrated Beamforming Arrays for 6G Communications

Abstract: Millimeter-wave (mmWave) integrated beamforming arrays stand as a pivotal enabling technology for the forthcoming age of wireless communications. In this presentation, we will start by introducing some high-performance designs of mmWave integrated radiating elements, which form the bedrock of a beamforming array. These elements play a vital role in determining the overall performance and functionality of the array. Subsequently, we will delve into a discussion on the various architectures of mmWave beamforming arrays. Understanding these architectures is crucial for grasping the diverse ways

in which beamforming can be implemented to achieve different communication objectives. Next, we will outline the research advancements our group has made in this field, encompassing both passive and active mmWave integrated beamforming arrays. Regarding passive mmWave integrated beamforming arrays, we will present two distinct design prototypes. One is a multibeam array antenna that harnesses a folded substrate-integrated waveguide (SIW) multimode beamforming network, enabling efficient and flexible beam manipulation. The other is a mmWave two-dimensional (2D) multibeam array antenna based on a substrate-integrated coaxial line (SICL) Butler matrix, which offers advantages in terms of compactness and performance. Moreover, our research has also ventured into the realm of three types of mmWave active beamforming arrays. Specifically, these include a K/Ka co#aperture integrated phased array, which allows for simultaneous operation in the K and Ka frequency bands; a mmWave D^3 phased array, known for its high performance and advanced features; and a single#board integrated mmWave asymmetric full-digital beamforming array, which offers a high level of integration and digital control.

Invited Speaker

16:20-16:40

Yong Wang

Hangzhou City University

Bio: Yong Wang received the B.Eng. degree from Southwest jiaotong University, Chengdu, China, in 2015, the Ph.D. degree from Zhejiang University, Hangzhou, China, in 2020. From 2020 to 2022, he worked as a post-doc researcher at Westlake University, Hangzhou, China. He is currently an associate professor in Hangzhou City University. His research interests include MEMS design and process, surface acoustic wave (SAW) sensor and microfluidics, and femtosecond laser micromachining.

Title: Flexible and Multi-Mode Acoustofluidics Enabled by Thin#Film Acoustic Waves

Abstract: Surface acoustic wave (SAW) technologies have garnered widespread attention in fluid manipulation, particle/cell manipulation, and lab-on-a-chip applications. Bulk piezoelectric materials, e.g., LiNbO3, are widely used for microfluidic actuators owing to their high piezoelectric constants and strong electromechanical coupling. However, their inherent rigidity poses challenges for integration with flexible, wearable devices or smart skins. Furthermore, their fixed thickness constrains the ability to excite multiple acoustic wave modes, thereby limiting the versatility of acoustofluidic functionalities. In contrast, piezoelectric thin films offer distinct advantages, including low cost, ease of deposition, and isotropic piezoelectric properties. For example, they can be deposited on a variety of substrates such as silicon, glass, polymers, and metals, enabling tunable acoustic wave propagation characteristics and diverse vibration modes. Notably, depositing piezoelectric thin films on flexible substrates facilitates the fabrication of flexible SAW devices. However, conventional flexible polymer substrates often introduce significant acoustic energy dissipation, thereby reducing microfluidic actuation efficiency. To mitigate this issue, piezoelectric thin films can be deposited on rigid metal substrates, with device flexibility achieved through substrate thinning. However, as the substrate thickness decreases, variations in the ratio of device wavelength to substrate thickness lead to transition in acoustic wave vibration modes, ultimately influencing microfluidic behaviors and performance. In this report, we will introduce the acoustic wave

vibration modes and fluid actuation behaviors of ZnO thin-film acoustic wave devices on aluminum substrates with varying thicknesses. By utilizing the fabricated flexible devices, we successfully achieve curved-surface fluid transportation. Additionally, multimodal excitation on a single chip enables the realization of diverse particle patterning behaviors. These innovations not only expand the application potential of flexible acoustofluidic devices but also provide new perspectives on the precise control of multimodal acoustic wave-driven microfluidics.

Invited Speaker

16:40-17:00

Renhua Yang

Shenzhen Polytechnic University

Bio: Renhua Yang is currently a Asistant Professor at Shenzhen Polytechnic University Technology of China. He received the Ph.D. degree in Microelectronics and Solid-State Electronics from City University of Hong Kong in 2023. And then he joined Hong Kong Hong Kong Productivity Council as a postdoctoral scientist. Her research field covers the micro/nano electronic science and technology, with an emphasis on hardware – algorithm co-design for AI systems.

Title: Artificial Intelligence for Next-Generation Resonator Systems

Abstract: The integration of Artificial Intelligence (AI) with Micro-Electro-Mechanical Systems (MEMS) presents a promising pathway toward intelligent sensing at the device level. Conventional MEMS resonator-based sensing systems typically rely on external signal processing and predefined physical models, which limits their adaptability to device nonlinearity, environmental variations, and long-term drift. Consequently, intelligence is often implemented at the system or cloud level rather than within the sensing device itself. This paper investigates a device-level intelligent resonator system, in which MEMS resonator sensors are tightly integrated with edge computing hardware to enable on-device learning and decision-making. By embedding machine learning algorithms directly into the resonator system, intelligence is realized at the device level, allowing real-time interpretation and processing of resonator signals. The proposed approach transforms the MEMS resonator into an autonomous and adaptive sensor node, capable of independent operation without reliance on external computation.

Oral Presentations

17:00-17:15	**Paper ID:** Oral# 17 **Paper Title:** Vacuum-Packaged Magnetic Cantilever Sensor Based on an Au-Au Thermocompression Bonding Technique **Presenter:** Gaopeng Xue, Harbin Institute of Technology
17:15-17:30	**Paper ID:** Oral# 119 **Paper Title:** A Mems Skewed Oscillating Mirror With a Dual-Resonance System for Photoacoustic CO2 Gas Detection **Presenter:** Penghong Shi, Harbin Institute of Technology

17:30-17:45	**Paper ID:** Oral# 251 **Paper Title:** A Low-Power Waveform-Following Linear Boost Drive Circuit for Piezoelectric Actuators in Piezoelectric Microrobots **Presenter:** Hong Feng, Shanghai Jiao Tong University
17:45-18:00	**Paper ID:** Oral# 308 **Paper Title:** Wafer-Level Porous WO3-TiO2 Heterojunction for Highly-Sensitive Ethanol Gas Sensors **Presenter:** Tianliang Meng, Hunan University

Technical Sessions

D4-PM-B12: Micro/Nanofabrication Techniques and Devices

16:00-17:40, April 20, 2026 **Convention Hall C**

Session Chair: Xuqian Zheng, Nanjing University of Posts and Telecommunications

Invited Speaker

16:00-16:20 **Xichen Yuan**

Northwestern Polytechnical University

Bio: Xichen Yuan is currently an associate professor at the School of Mechanical Engineering, Northwestern Polytechnical University, China. His research focuses on micro structure fabrication, microfluidic chips and advanced medical instruments. His primary academic achievements lie in the field of biosensing technologies for extreme environments, particularly in microgravity, ultra-low pressure, and complex biological conditions. His research outcomes have been successfully applied to the "Green Voyager" 180-day manned mission and Mars exploration tasks. The biosensing chip technology he led was selected as a candidate payload for microbial detection in the "Tianwen-3" Mars mission. Over the past five years, he has published more than 30 SCI-indexed papers as first or corresponding author, filed 23 invention patents, and served as principal investigator for 10 national projects, including key military projects, with total funding exceeding 10 million RMB.

Title: An Arch Notched Tapering Microchannel for Sheathless Inertial Flow Cytometry: Overcoming Sidewall Verticality Constraints for High-Performance Leukocyte Analysis

Abstract: Polydimethylsiloxane (PDMS) microfluidic chips utilize an arch notched tapering structure as their core functional unit to achieve sheathless inertial focusing and high-performance optical detection. The precisely designed microchannel geometry induces enhanced secondary flow, enabling single-stream co-focusing of multi-sized particles without sheath fluid, thereby simplifying the fluidic system and reducing sample consumption. Controlling micro-nanofabrication structural tolerances, particularly sidewall verticality, is critical for efficient optical signal collection in flow cytometry optical detection systems. This work fabricated silicon molds via deep reactive ion etching and replicated PDMS chips. The process successfully produced high-aspect-ratio microstructures with well-controlled sidewall verticality (89.5° – 90.3°). When testing 30-fold diluted whole blood, the chip attained a leukocyte inertial co-focusing efficiency of 98.86%. Optimized sidewall verticality confined the fluorescence detection coefficient of variation to 2.67% – 3.19%, improving leukocyte subpopulation analysis accuracy, with results deviating less than 2.0% from commercial instruments. In batch fabrication, three-dimensional positional accuracy of the microchannels was maintained within ±5 μm, ensuring consistency crucial for reliable operation of these disposable, plug-and-play chips. This integration of innovative design,

precision manufacturing, and stringent quality control advances the potential of microfluidic flow cytometry for clinical diagnostics.

Invited Speaker

16:20-16:40

Lifeng Wang

Southeast University

Bio: Lifeng Wang is currently a Professor at School of Electronic Science & Engineering, Southeast University (SEU). He received his B.S. degree, M.S. degree, and Ph.D degree in electrical engineering from Southeast University, Nanjing, China, in 2003, 2006, and 2013, respectively. From 2006 to 2008, he was with the Nanjing Electronic Device Institute, where he worked on silicon micromechanical devices. From 2013, he joined the faculty of the Department of Electronic Engineering, Southeast University, as an assistant professor, where he became a professor in 2025. From 2019 to 2020, he is a visiting scholar at the University of Cambridge.

Prof. Wang has authored over 50 peer-reviewed international journals/ conference papers, holds over 30 Chinese patents, and one international book chapter. In recognition for his research accomplishment, Prof. Wang won over 10 academic awards. He also served as TPC member and session chair for IEEE Sensors and APCOT conference. His current research interests include the design, fabrication and reliability of RF MEMS, micromachined resonators and sensors.

Title: Wafer-level Packaged Highly Reliable RF MEMS Switches

Abstract: International research on RF MEMS (Radio Frequency Micro - Electro - Mechanical Systems) switches began as early as 1995. To date, a variety of RF MEMS switches based on different principles, structures, and fabrication processes have been developed. Compared with traditional solid-state semiconductor RF switches, RF MEMS switches offer distinct advantages in terms of insertion loss, linearity, and power consumption, making them highly suitable for applications such as phased array radars, portable wireless communication systems, and RF/microwave test instruments. This work aims to enhance switch reliability through a three-pronged approach encompassing structural design, key fabrication processes, and wafer-level packaging, thereby realizing a hermetic packaged highly reliable RF MEMS switch.

Invited Speaker

16:40-17:00

Min Tu

Shanghai Institute of Microsystem and information Technology, Chinese Academy of Sciences

Bio: Prof. Min Tu obtained his Ph.D. in 2015 from Ruhr University Bochum in Germany, under the supervision of Prof. Roland A. Fischer (now at TU Munich). Supported by a Marie Skłodowska-Curie Actions Fellowship, he worked as a postdoctoral fellow at KU Leuven in

Belgium, mentored by Prof. Rob Ameloot. As of 2021, he has been leading his independent group at Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences. His research interests focus on the advancing micro- and nanofabrication techniques to integrate nanoporous materials into solid-state miniaturized devices. Prof. Min Tu has published more than 50 peer-reviewed papers (Nat. Mater., Nat. Commun., Angew. Chem., ACS Nano, Adv Funct. Mater., ACS Sensors, etc.).

Title: Direct Resist-Free Patterning of Metal-Organic Frameworks and Its Applications

Abstract: Metal-organic frameworks (MOFs) offer unique prospects in micro and optoelectronics, such as low-k dielectrics, photodetectors, and chemical sensors. Surface engineering is essential for integrating metal-organic frameworks (MOFs) in miniaturized solid-state devices. To achieve this, resist-free lithography of functional materials is desirable to minimize the number of process steps and possible contamination sources, especially for highly porous materials. In this presentation, we introduce a scalable thin-film deposition method and a resist-free nanoscale MOF patterning strategy. We developed a robust deposition technique that enables high-quality MOF thin film deposition with a controllable thickness. By incorporating irradiation-sensitive moieties with the frameworks or pores, MOFs can be directly patterned by UV, X-ray, e-beam, and EUV lithography, eliminating the need for photoresists. This straightforward approach enables high-quality MOF patterns in which all desirable material properties are maintained. The compatibility of these lithography techniques with existing nanofabrication processes provides a new perspective on the potential of MOFs as high-performance dielectrics and coatings for more selective and sensitive sensors.

Invited Speaker

17:00-17:20

Liujing Zhuang

Zhejiang University

Bio: Dr. Liujing Zhuang is a New Hundred Talents Program Assistant Professor, a faculty member, in Biosensor National Special Laboratory, Key Laboratory for Biomedical Engineering of Education Ministry, Department of Biomedical Engineering, Zhejiang University, China. She received the B.S., Ph.D. degrees from Zhejiang University in Biomedical Engineering in 2011, 2017, respectively. She has been awarded a scholarship from the China Scholarship Council to pursue her study as a joint PhD student at Perelman School of Medicine, Department of Neuroscience, University of Pennsylvania from 2015 to 2016. Her current research focuses on: 1) olfactory brain-machine interface; 2) biomimic olfactory biosensors, 3) neural mechanisms underlying olfactory perception.

Title: Reading Spatiotemporal Responses of Mammalian Olfactory System via Microelectrode Arrays

Abstract: Humans perceive the world through five senses, of which olfaction is the oldest evolutionary sense that enables the detection of chemicals in the external environment. Recent progress in bioinspired electronics have boosted the development of artificial sensory systems. Here, we propose a biohybrid olfactory system by integrating living mammals with implantable flexible neural electrodes, to employ the outstanding properties of mammalian olfactory system. The initial event of olfactory perception occurs in

the olfactory epithelium (OE) inside the nasal cavity, which is the peripheral organ for the sense of smell. The olfactory bulb (OB) is the first relay station of the central olfactory system. It receives input from OE and sends output to the olfactory cortex. The olfactory information encoded in the neural activity was recorded from both OE and OB simultaneously using flexible neural electrodes. By extracting the characteristics of odor-evoked oscillatory signals, responses of different odors are identified and classified with 90% accuracy.

Poster Sessions

Award Finalist Session: Best Poster

15:00-17:00, April 18-20, 2026 **Poster Area - 3F**

Session Chairs:
Xudong Zou, University of Chinese Academy of Sciences
Wei Tang, Beijing Institute of Nanoenergy and Nanosystems, CAS

Order	Paper ID	Details
001	**Poster# 7**	**Paper Title:** Laser-Etched and Electroless Copper-Plated Skin-Like Shear-Force Sensors for Robotic Perception **Authors:** Hongwei Xie, Zhenlong Huang, Longpeng Yang, Tao Chen, Taisong Pan and Yuan Lin
002	**Poster# 23**	**Paper Title:** Design and Implementation of a Digital Pressure Sensor Evaluation System **Authors:** Jie Yu, Xinhao Li, Cheng Gu, Hui Feng, Bo Chen and Hong Zhang
003	**Poster# 24**	**Paper Title:** A Universal On-Wafer Structure for In-Situ Extraction of Maximum Crack Size on Deep-Etched Sidewalls **Authors:** Jiakang Li and Dacheng Zhang
004	**Poster# 31**	**Paper Title:** High-Performance High-Pressure Silicon Resonant Pressure Sensor for Extreme Environment Applications **Authors:** Pengxiang Ye, Xiaohan Liu, Zhaoyuan Tan, Hao Wang, Bo Xie, Yulan Lu, Deyong Chen and Junbo Wang
005	**Poster# 69**	**Paper Title:** A Tri-Axial Force Sensor Based on MEMS Technology for Surgical Robots **Authors:** Shuai Ma, Yuyang Sun, Wenjun Huo, Ruxiao Yang, Zhicun Zhou, Wei Zhang, Dongsheng Li and Huicong Liu
006	**Poster# 70**	**Paper Title:** System-Level Simulation of a Resonant Electrostatic Field Microsensor Based on a Reduced-Order Macro-Model **Authors:** Haodong Zhang, Junjie Wang, Junjie Wen, Zaifa Zhou and Zhengwei Wu
007	**Poster# 79**	**Paper Title:** Glass Isolated TSVs with Overflow Isolation Rings for MEMS Devices **Authors:** Yi Tang, Zhiyu Sun, Jiaxu Liu, Jian Cui and Qiancheng Zhao
008	**Poster# 85**	**Paper Title:** Bandwidth Expansion of Piezoelectric Micromachined Ultrasonic Transducers via Combined DC Bias and Time-aligned Superposition **Authors:** Ke Zhu, Shuhan Liang, Wangyang Zhang, Yuchen Mao, Wenhe Yang, Xiaojing Mu and Jin Xie
009	**Poster# 91**	**Paper Title:** A High-Accuracy All-Silicon Resonant Pressure Sensor with Rapid Thermal Response and Corrosion-Resistant Electrode Protection Structure **Authors:** Xiaohan Liu, Bowen Tan, Xingyu Li, Bo Xie, Yulan Lu, Junbo Wang, Deyong

		Chen and Peiyue Zhao
010	**Poster# 99**	**Paper Title:** A Study on the Interference Suppression of CMOS MEMS Monolithic Integrated Infrared Detectors Under Environmental Temperature Variations and Electromagnetic Radiation **Authors:** Jiagen Cheng, Wanli Jiang, Weihuang Yang, Yu Gao, Chaoran Liu, Dehui Xu and Linxi Dong
011	**Poster# 116**	**Paper Title:** A Machine Learning-Enhanced Cylindrical Multilayer Dual-mode Triboelectric Nanogenerator for Intelligent Multi-modal Sensing **Authors:** Dezheng Hu, Jun Li and Wei Ou-Yang
012	**Poster# 124**	**Paper Title:** Identification of Multiple Harmonic Mass Imbalance in Micro-Hemispherical Resonant Gyroscopes via Vibration Transmission **Authors:** Shuping Yang, Yan Shi, Kun Lu, Sheng Yu, Jiangkun Sun and Xiang Xi
013	**Poster# 125**	**Paper Title:** Microstructural Evolution of Cr/Au Films on Fused Silica after Vacuum Annealing **Authors:** Mengxue Li, Jia Liu, Feng Zhu, Yan Shi and Xiang Xi
014	**Poster# 138**	**Paper Title:** A Wafer-Level Thin-Film Vacuum Encapsulation Process for High-Sensitivity Silicon MEMS Resonant Differential Pressure Sensors **Authors:** Bowen Tan, Xingyu Li, Bo Xie, Yulan Lu, Jian Chen, Deyong Chen and Junbo Wang
015	**Poster# 156**	**Paper Title:** Effect of Metal Film Thermoelastic Damping on the Q-factor of Fused Silica Resonator：Modeling and Simulation **Authors:** Feng Zhu, Xuezhong Wu, Yan Shi, Yanchao Reng, Guodong Duan and Xiang Xi
016	**Poster# 166**	**Paper Title:** Fabrication of High-Quality Nanogap Electrodes via Structurally Optimized Atomic Layer Lithography **Authors:** Shijie Zhao, Mingdi Zhang, Ziying Hu, Haonan Ma, Xia Liu and Yeliang Wang
017	**Poster# 167**	**Paper Title:** Recent Advances in AI-Integrated Wearable Sensors for Disease Monitoring **Authors:** Tao Dong, Wangang Zhu, Chenghui Yu, Lu Yao, Bingde Zou, Jihua Zou, Jianghua Jia, Fang Liang, Jiao Yang, Yang Zhaochu, Wen Tao and Jiang Zhuangde
018	**Poster# 169**	**Paper Title:** Polarity Modulation in $MoTe_2$ Vertical Transistors via Contact Metallization Engineering **Authors:** Ziying Hu, Mingdi Zhang, Hongtao Li, Zeming Jin, Xia Liu and Yeliang Wang
019	**Poster# 171**	**Paper Title:** High-Quality-Factor Micro Hemispherical Resonators Achieved by Rim Width Modulation **Authors:** Dunxiang Jian, Anye Su and Yan Shi
020	**Poster# 173**	**Paper Title:** Physical Reservoir Computing on the Basis of a POM/SWCNT Heterojunction

		Authors: Yanhao Wang, Yuyao Wang, Fan Zhang, Mengbo Qi, Yuyang Duan and Wenli Zhou
021	**Poster# 182**	**Paper Title:** Thiolated TiO2 Thin Films Based Flexible Patch for Real-time Detection of L-cysteine in Sweat **Authors:** Xiangjie Chen, Jia Zhu, Taisong Pan, Guang Yao, Min Gao and Yuan Lin
022	**Poster# 184**	**Paper Title:** Multi-Frequency Excitation for Performance Enhancement of Electric Field Mill Beyond the Critical Duffing Amplitude **Authors:** Hongyun Ren, Lifang Ran, Najib Kacem, Jianhua Li, Xiaolong Wen and Ashwin A Seshia
023	**Poster# 192**	**Paper Title:** Micro-Fabrication Workflow of Customized Ordered Porous Structure Using Two-Photon Polymerization **Authors:** Hao Bian, Huimin Wen, Minmin You, Jingquan Liu and Zude Lin
024	**Poster# 194**	**Paper Title:** Thermal Oxidation-Based Laser Additive Manufacturing and Grayscale Structuring **Authors:** Haonan Ma, Shijie Zhao, Hongtao Li, Xia Liu and Yeliang Wang
025	**Poster# 207**	**Paper Title:** A Hybrid Surface-Deep Flexible Array for Simultaneous Cross-Scale Neural Recordings in Freely Moving Mice **Authors:** Yunfu Luo, Zhitao Zhou, Xiaoling Wei, Yifei Ye and Liuyang Sun
026	**Poster# 209**	**Paper Title:** A High-Sensitivity Electric Field Sensor Based on Nonlinear Frequency Difference in a Clamped-Clamped Beam Resonator **Authors:** Weiyang Li, Pinyi Li, Najib Kacem, Hongyun Ren, Jianhua Li, Ashwin A Seshia and Xiaolong Wen
027	**Poster# 212**	**Paper Title:** Influence of High-Temperature Annealing on the Quality Factor of Fused-Silica Micro-Hemispherical Resonators **Authors:** Liao Chen, Anye Su, Yulie Wu, Kun Lu, Xiang Xi and Yan Shi
028	**Poster# 237**	**Paper Title:** Silicon-based Piezoelectric MEMS Liquid Pump with Fully Integrated Check Valve Structure **Authors:** Jiafeng Ni
029	**Poster# 245**	**Paper Title:** A Parallel-Resonance-Enhanced Synchronous Magnetic Flux Extraction Circuit for Electromagnetic Energy Harvesters on AC Transmission Lines **Authors:** Shanghao Gu, Weihan Xu and Fei Wang
030	**Poster# 248**	**Paper Title:** A Unified Design Methodology for Inertial Electromechanical Sigma Delta Modulator **Authors:** Yuzhao Wang, Hua Li, Shuaimin Wang, Yi Zhou and Weimin Yang
031	**Poster# 310**	**Paper Title:** Non-Driven Interferometric Visualization of Vibrational Modes in Gold Nanomechanical Resonators **Authors:** Jiaqi Wu, Luming Wang, Bo Xu, Kuai Yu, Zenghui Wang and Jiankai Zhu
032	**Poster# 272**	**Paper Title:** Design of a Piezoelectric FSM with Asymmetric Structure and Segmented

		Electrodes **Authors:** Haoxiang Li, Lin Zhang, Huijun Yu and Wenjiang Shen
033	**Poster# 291**	**Paper Title:** The Application of CuO Nanoparticle Decorated Ti3C2 MXene Composite for High Performance NO2 Gas Sensor at Room Temperature **Authors:** Jiulong Liu, Qi Bao, Yufei Yan, Wenlei Zhang, Zhongyun Yuan and Lei Sun
034	**Poster# 306**	**Paper Title:** A High-Voltage Optocoupler – Based Controlled Discharge Method for Improving the Driving Performance of Electrohydraulic Actuators **Authors:** Xinyao Peng, Lefei Zhang, Wenyang Yu, Tongtong Liu, Jiemin Yao and Kai Tao
035	**Poster# 325**	**Paper Title:** A Self-Powered Wireless Sensing System Based on Array Piezoelectric Energy Harvester **Authors:** Yi Yang, Pengfan Wu, Chenxi Zhao, Danni Yang, Xueyi Xia and Xiaojing Mu
036	**Poster# 327**	**Paper Title:** Contact Material Recognition Device Based on Electronegativity Difference **Authors:** Hui Liu, Jun Li, Han Wu and Wei Ou-Yang
037	**Poster# 331**	**Paper Title:** Ultrahigh-Output Liquid – Solid Triboelectric Nanogenerators Enabled by Coupled Localized Surface Plasmon Resonance and Interfacial Polarization **Authors:** Fayang Wang, Wenyi Tu, Pengfan Wu, Endian Cui and Xiaojing Mu
038	**Poster# 347**	**Paper Title:** Characterization and Suppression Methods for the Charge Accumulation Effect in MEMS Resonators **Authors:** Zhenyu Zhong, Mingze Gao, Jiangkun Sun, Sheng Yu, Yongmeng Zhang, Xuezhong Wu and Dingbang Xiao
039	**Poster# 352**	**Paper Title:** A Vibration Energy Harvester Based on PZT Multilayer Composite Piezoelectric Thin Films **Authors:** Danni Yang, Jizhen Li, Yihui Song, Pengfan Wu, Endian Cui, Fayang Wang and Xiaojing Mu
040	**Poster# 356**	**Paper Title:** Few-Layer MoSe2 Nanomechanical Resonator with High Laser-Power-to-Frequency Responsivity at Room Temperature **Authors:** Yalan Wang, Shuang Cai, Jiankai Zhu, Zenghui Wang and Bo Xu

Poster Session 01

15:00-17:00, April 18-20, 2026 | **Poster Area - 3F**

041	**Poster# 11**	**Paper Title:** Integrated Separation and Digital Counting of Circulating Cancer-Derived Exosomes in Whole Blood via a Lab-on-a-Disc Platform **Authors:** Ci-Syuan Lyu and Ju-Nan Kuo
042	**Poster# 12**	**Paper Title:** Metamaterial-Enhanced Asymmetrical Wireless Power Transmission System for Optogenetics **Authors:** Jin Yang, Lingjie Jia and Xiuhan Li
043	**Poster# 113**	**Paper Title:** Ultrasound-Responsive Piezo-Metabolic Composite Hydrogels: A Fiber-Reinforced Synergistic Platform for Chronic Wound Reconstruction **Authors:** Zhang Kaihang, Lu Jiaqi and Luo Jikui
044	**Poster# 190**	**Paper Title:** Liquid Metal-Polymer based Flexible Electrodes for Recording Electrophysiological Signal from Myocardial Tissue **Authors:** Dingyuan Yu, Chenyang Zhou and Xiaolin Wang
045	**Poster# 218**	**Paper Title:** Design and Analysis of a Dual-Terminal Differential-Electrode Piezoelectric Micromachined Ultrasonic Transducer Based on PZT Thin Film **Authors:** Ziyi Liu
046	**Poster# 223**	**Paper Title:** Harnessing Nanotechnology: A Multi-Pathway Approach to Combat Non-Compressive Sciatica **Authors:** Yi Zhang, Mengxiao Tantai and Zhidong Lu
047	**Poster# 228**	**Paper Title:** A Sim2Real-Driven Adaptive Upper-Limb Rehabilitation System Using Magnetically Actuated Micro-Robots **Authors:** Huifeng Shi, Yi Zhang and Xiaosheng Zhang
048	**Poster# 233**	**Paper Title:** An Integrated Flexible Dual-Channel Strain – Pressure Sensor for Fetal Movement Monitoring **Authors:** Jinjin Cao, Shuhua Zhao and Lu Bai
049	**Poster# 263**	**Paper Title:** High Resolution Monitoring of Biochemical Reactions by a Chip-based Microfluidic Calorimeter **Authors:** Ziyi Wang, Yi Chen, Wei Ji, Guoli Tian, Zhuoqing Yang and Congchun Zhang
050	**Poster# 301**	**Paper Title:** Development of a Dual-layer Symmetric ITO Heating Film on Flexible PET Substrate with Enhanced Magnetic Field Suppression for Atomic Vapor Cell **Authors:** Jianwei Hou, Nan Zhao, Jiaxiang Wang, Mengqiu Li, Faheng Zang and Zhuoqing Yang
051	**Poster# 249**	**Paper Title:** An Electrostatic Parallel-Plate Actuated MEMS Micromirror Array **Authors:** Shiyuan Lin, Wenjiang Shen and Jinrong Cheng

052	**Poster# 340**	**Paper Title:** Fold-and-Stack Multilayer Micro-Coil Patch for Conformal, Non-Invasive Magnetic Neuromodulation **Authors:** Yao Zhang, Byung Yang Lee and Yi Jae Lee
053	**Poster# 367**	**Paper Title:** High Q-factor and Fast-Response Micro Resonators with Hole-Optimized Approach for Viscosity Sensing **Authors:** Song Qu and Cao Xia
054	**Poster# 392**	**Paper Title:** Gas Chromatography System for Metal Oxide Gas Sensor to Enhance Gas Species Selectivity **Authors:** Kuan Wen Lou, Guangyao Cheng, Qinru Xiao and Yi-Ping Ho
055	**Poster# 399**	**Paper Title:** A Low-Power, Large-Comb-Spacing, High-Integration RF Frequency Comb Generator Based on Parametric Excitation **Authors:** Jia You, Wei Huang, Zhujie Zhao, Zihan Xu, Kaidong Chen and Cao Xia
056	**Poster# 403**	**Paper Title:** Dynamically Self-Adjustable Liquid-Liquid and Self-Adaptive Soft-Contact Solid-Solid Triboelectric Nanogenerator for Wave Energy Harvesting **Authors:** Bingqi Zhao and Yong Long
057	**Poster# 405**	**Paper Title:** A Self-Adaptive Ellipsoidal Pendulum Triboelectric Nanogenerator with Soft-Contact Enhancement for Efficient Wave Energy Harvesting **Authors:** Xinyue Jian and Yong Long
058	**Poster# 430**	**Paper Title:** Cmut-Based Cardiovascular Function Detection **Authors:** Baoli Wu, Renxin Wang, Guojun Zhang, Jiangong Cui, Yuhua Yang, Changde He, Licheng Jia, Chenbin Ma, Wenshu Dai, Xianglian Liu and Wendong Zhang

Poster Sessions

Poster Session 02

15:00-17:00, April 18-20, 2026 **Poster Area - 3F**

Order	Paper ID	Details
001	**Poster# 8**	**Paper Title:** Preparation of Microstructure Glass Using Metal-Assisted Chemical Etching Formed Silicon Substrate as a Mold **Authors:** Minjie Zhu, Fanhong Chen, Shuai Liu, Kehan Zhu, Ruichao Lian, Xiaojuan Li, Haifei Song, Yiming Zhong, Yun Chen and Xiaohui Du
002	**Poster# 19**	**Paper Title:** A Non-Contact Fingertip Localization System Based on CMUT Arrays **Authors:** Zhongyi Fan, Zhou Zheng, Xiaomin Wang, Hui Chen and Zhendong Sun
003	**Poster# 25**	**Paper Title:** Chitosan Nanofiber- Bismuth Telluride Composite Film for Micro Thermoelectric Generator **Authors:** Jianghan Tian, Nguyen Van Toan and Takahito Ono
004	**Poster# 27**	**Paper Title:** A Wideband Lumped-Element Hybrid Coupler Using T-type Network **Authors:** Ziyue Song, Zihang Chang and Wenjuan Liu
005	**Poster# 33**	**Paper Title:** Abstract: Research on Flexible Sensors Based on Embedded 3D Printing **Authors:** Shengyu Gao, Xiaosheng Zhang and Yi Zhang
006	**Poster# 43**	**Paper Title:** Ultrathin Few-Layer V2N MXene via Cell-Ultrasonic-Assisted Exfoliation for High-Voltage Aqueous Energy Storage **Authors:** Liping Zhang and Hongjie Jiang
007	**Poster# 45**	**Paper Title:** Integrin-targeted Delivery of Redox Homeostasis Regulating Lanthanide-based Composite Nanoplatform for Deep Self-enhanced Photodynamic/H2S Gas Synergistic Therapy via 1530 nm Activation **Authors:** Jitong Gong, Jing Feng and Hongjie Zhang
008	**Poster# 46**	**Paper Title:** Surface Plasmon Resonance Monitoring of Tunable Silica Shell Growth (8–47 nm) on Silver Decahedral Nanocomposites **Authors:** Nimer Murshid and Vladimir Kitaev
009	**Poster# 47**	**Paper Title:** Transition- Metal- Doped ZnO as a Tunable Nano- Composite Material: Structural, Electronic, and Optical Modifications via DFT **Authors:** Rasool Akhtar Alias Osama, Hannah Levene, Graham Wood, Peter Lomax and Rebecca Cheung
010	**Poster# 55**	**Paper Title:** Long-Term Reliability Analysis of MEMS Double-Level Vacuum Packaging Using a Coupled FEM-ODE Approach **Authors:** Wanjing Lin, Jing Lin, Qiancheng Zhao, Guizhen Yan, Qinwen Huang and Chunhua He

011	**Poster# 67**	**Paper Title:** Evaluation of Stiffness Asymmetry in MEMS Tuning-Fork Resonators Based on Fast Geometric Observations **Authors:** Yi Tang, Chenggang Zhang, Chenzhe Du, Qiancheng Zhao and Jian Cui
012	**Poster# 74**	**Paper Title:** A Robust Optimization Method For MEMS Bonding Wires Based On Multi-factor Analysis And Taguchi Design **Authors:** Wanjing Lin, Jing Lin, Qiancheng Zhao, Guizhen Yan, Qingwen Huang and Chunhua He
013	**Poster# 77**	**Paper Title:** Ultra-wideband AlScN BAW Filter Based on Integrated Cap Wafer Inductor **Authors:** Danyu Mu, Weipeng Xuan, Gang Liu, Rui Ding, Feng Gao, Hao Jin, Jikui Luo and Shurong Dong
014	**Poster# 87**	**Paper Title:** Multi-electrode Design Enhances the Multi-mode Performance of Piezoelectric Micromachined Ultrasonic Transducers **Authors:** Ke Zhu, Shuhan Liang, Wangyang Zhang, Yuchen Mao, Xiaojing Mu and Jin Xie
015	**Poster# 88**	**Paper Title:** A Responsivity-Enhanced FM Lorentz Force MEMS Magnetometer via Structural Optimization **Authors:** Xuepeng Luo, Cheng Tu and Xiaosheng Zhang
016	**Poster# 96**	**Paper Title:** Performance Enhancement of Resonant Accelerometers **Authors:** Hengze Du, Yu Chen, Cheng Tu and Xiaosheng Zhang
017	**Poster# 100**	**Paper Title:** Design and Fabrication of Low-Power MEMS Microheaters **Authors:** Fan Zhao, Zhiyuan Jiang, Xiangrui Jiang, Wang Ruihao, Hairong Wang and Lingmin Yu
018	**Poster# 108**	**Paper Title:** SAW Pressure Sensor Based on X-cut LiNbO3 structure **Authors:** Julong Li, Cheng Tu and Xiaosheng Zhang
019	**Poster# 109**	**Paper Title:** Underwater Acoustic Source Localization via Deformable Frequency Feature Fusion and Uncertainty-Guided Multi-Task Learning **Authors:** Daoguang Zhang, Wanjing Lin, Nengkun Fang, Kangzhao Tan, Junjie Yu and Chunhua He
020	**Poster# 118**	**Paper Title:** A High-Accuracy Resonant Pressure Microsensor Packaged with a Thick Glass Base **Authors:** Yaxuan Fang, Yulan Lu, Bo Xie, Deyong Chen, Junbo Wang, Jian Chen, Wei Guan and Xinju Fu
021	**Poster# 147**	**Paper Title:** Antibacterial Hydrogels: A Promising Strategy for Chronic Wound Repair **Authors:** Zihang Cao, Rui Zhang and Shengtai Bian
022	**Poster# 178**	**Paper Title:** Self-Powered Sensor Solution for HVDC Grids: A High-Gain Parallel BOOST Energy Harvester **Authors:** Bingchen Wang, Xinyi Wang and Yunjia Li

023	**Poster# 185**	**Paper Title:** Q- Factor Enhancement through Energy Control by Blue- Sideband Pumping in a Mode- Localized Electric- Field Sensor **Authors:** Pinyi Li, Lifang Ran, Najib Kacem, Jianhua Li, Xiaolong Wen and Ashwin A Seshia
024	**Poster# 193**	**Paper Title:** Fast Design and Verification of BAW Filters Based on Graph Neural Networks **Authors:** Zhengcai Zhao, Danyu Mu, Rui Ding, Weipeng Xuan, Feng Gao, Jikui Luo and Shurong Dong
025	**Poster# 195**	**Paper Title:** Metal-Organic Framework Derived Porous Carbon for Simultaneous Electrochemical Sensing of Uric Acid and Dopamine **Authors:** Pengkai Tang, Min Gao and Yuan Lin
026	**Poster# 199**	**Paper Title:** High Performance Flexible Calorimetric Flow Sensor Based on Kirigami-Structured Substrate for Complex Surface Bonding Scenarios **Authors:** Kai Qiao, Daishan Yue, Hanlun Guan, Jianyu Wang, Zong Liu, Huikai Xie and Xiaoyi Wang
027	**Poster# 201**	**Paper Title:** A High-Sensitivity Piezoelectric MEMS Accelerometer Based on Differential Signal Detection **Authors:** Yuancheng Ouyang, Wenjun Xu, Guojian Ding, Qianyi Liu, Fan Wu, Qi Feng, Yang Wang, Miao He and Haiqiang Jia
028	**Poster# 203**	**Paper Title:** A High-Load Large-Stroke MEMS Micro-motion Platform Based on Polyimide/Al Bimorph for Optical Image Stabilization **Authors:** Jingyi Chen, Zonghao Li, Hengzhang Yang, Senlin Jiang, Huikai Xie, Xiaodan Mao and Leqi Yu
029	**Poster# 205**	**Paper Title:** Structural Design and Optimization of MEMS Piezoresistive Accelerometer with Wide Bandwidth and High Shock Resistance **Authors:** Boyang Li, Chen Jia and Xiangguang Han
030	**Poster# 211**	**Paper Title:** A Piezoelectric MEMS Tuning Fork-Shaped Resonator with Fan-Shaped Reflectors **Authors:** Jiaming Wang, Yuxin Ruan, Jiahui Xu, Yinfeng Liu, Yifan Wang and Quan Yuan
031	**Poster# 215**	**Paper Title:** Coupled-beam Coupled Type Constant-temperature MEMS Resonator **Authors:** Yuxuan Wu, Hangbing Xiao, Haopeng Xu, Jiaming Wang, Yuxin Ruan and Quan Yuan
032	**Poster# 216**	**Paper Title:** Deep Learning Classification Method of EEG Signals Based on Grouped Convolution and Attention Mechanism **Authors:** Yuxin Ruan, Yangyang Chai, Jiaming Wang, Yinfeng Liu, Jiahui Xu and Quan Yuan
033	**Poster# 232**	**Paper Title:** Center-of-Mass Adjustment of Precision Force-Balanced Sensors with Adhesive Dispensing

		Authors: Zhinan Si, Sien Xiao, Xiaodong Wang, Zhengsu Zou, Zihan Zhang and Zheng Xu
034	**Poster# 239**	**Paper Title:** A Rope-Driven Rotational Hybrid Energy Harvester For Low-Frequency Kinetic Energy Harvesting **Authors:** Shumiao Xuan, Weihan Xu and Fei Wang
035	**Poster# 240**	**Paper Title:** Sustainable Chitosan/rice Husk Silica/calcium Alginate Composite Beads for pH-Responsive Oral Delivery of Folic Acid **Authors:** Nutatcha Yowcharoensuk, Chayanan Manawongcharoen, Phuwit Suwannatain, Kamolnid Rochanasiri, Jidapa Pimthong and Sakdinun Nuntang
036	**Poster# 241**	**Paper Title:** Amine Functionalized Rice Husk Silica as a Sustainable Adsorbent for Urea Removal in Artificial Kidney Applications **Authors:** Jedsadaporn Fakthong, Natwalai Orachaipunlap, Napaphat Pripwai, Kawissara Pholdee, Natchamon Chaiyos and Sakdinun Nuntang
037	**Poster# 242**	**Paper Title:** Tunable Energy Transfer in MEMS Resonators with Electrostatic Coupling Under Parametric Excitation **Authors:** Lei Wang, Ming Lyu, Zhikun Zha, Feixuan Wei, Yu Zeng and Wenxin Wu
038	**Poster# 273**	**Paper Title:** Hybrid Passive-Active Nonlinearity Compensation for Mode-Localized Coupled Resonators **Authors:** Zisheng Lei, Haojie Li, Jingxue Song, Xiaoying Li and Hemin Zhang
039	**Poster# 274**	**Paper Title:** Inorganic Salt and Thermal Stretching Synergize to Achieve Strong, Tough, Conductive and Recyclable Hydrogels **Authors:** Shiqian Yu, Xiaojing Jing and Ruonan Jia
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041	**Poster# 295**	**Paper Title:** A Battery-Free Wireless Tactile Sensor for Multimodal Force Perception **Authors:** Haicheng Gu, Yina Liu and Zhen Wen
042	**Poster# 298**	**Paper Title:** Strain-Insensitive Stretchable Triboelectric Tactile Sensors via Interfacial Stress Dispersion **Authors:** Liming Zhang, Yina Liu and Zhen Wen
043	**Poster# 304**	**Paper Title:** Study on the Output Performance of Triboelectric Nanogenerators Driven by Rotating Magnetic Fields **Authors:** Xinyue Wang, Hui Li, Huizhen Liu, Wenchao Li, Song Li, Yuan Tang, Kexin Tang and Yongyue Zhao
044	**Poster# 311**	**Paper Title:** Design of a High-performance and Compact Switched BAW Filter Bank **Authors:** Tangwei Hu, Yang Gao and Tingting Liu
045	**Poster# 323**	**Paper Title:** High-Performance Streaming Current Generator Based on the Ion Rectification Effect

		Authors: Endian Cui, Yifan Bu, Danni Yang, Pengfan Wu, Fayang Wang, Wangyang Zhang, Jiaqian Yang, Xianglong Chen and Xiaojing Mu
046	**Poster# 330**	**Paper Title:** Spatially Resolved Visualization of Multimodal Motion in Microelectromechanical Resonators **Authors:** Jiankai Zhu, Jiahao Song, Jiaqi Wu, Ziluo Su, Bo Xu, Xueyong Wei and Zenghui Wang
047	**Poster# 341**	**Paper Title:** Development of an Iontronic Pressure Sensor for Blood Flow Measurements **Authors:** Zixiang Zhang, Shaoqi Tang, Lili Li, Liyu Lin, Zhizhong Wang and Zhongliang Yu
048	**Poster# 363**	**Paper Title:** Sol-Gel Fabrication of High-Performance Ternary $Pb(Mn,Nb)O_3$ -$Pb(Zr,Ti)O_3$ Relaxor Ferroelectric Thin Films on Si Substrates **Authors:** Jiaqian Yang, Xiaojing Mu and Jixuan Zhang
049	**Poster# 372**	**Paper Title:** High-Performance Evaporation-Induced Generator Based on MOF-Based Composite Materials **Authors:** Yifan Bu, Liangzhi Zhang, Endian Cui, Danni Yang, Xueyi Xia and Xiaojing Mu
050	**Poster# 385**	**Paper Title:** Nature-Inspired Zein Nanofiber Architectures for High-Performance Energy Storage Device **Authors:** Young-Hwi Jo and Jin-Heong Yim
051	**Poster# 393**	**Paper Title:** A Legendre-Corrected Analytical Model for Modal Coupling in LiNbO3 XBAR Resonators **Authors:** Xinxuan Xu, Longfei Yang and Linyan Liu
052	**Poster# 404**	**Paper Title:** Effects of Back-Side sub-50- μ m Wafer Thinning on Ultra-Thin Bipolar Analog IC Performance **Authors:** Neng Gao, Ying Chen, Zhaoxian Wang, Xin Song and Dongliang Liu
053	**Poster# 420**	**Paper Title:** Design Optimization of an Octopus Tentacle-Inspired Ciliary Flow Velocity Sensor Based on MEMS **Authors:** Yuxin Sun, Jiangong Cui, Renxin Wang and Guojun Zhang
054	**Poster# 421**	**Paper Title:** Design of Bionic Differential Pressure Sensor Based on MEMS Cross-Beam Structure **Authors:** Yukun Liu, Jiangong Cui, Renxin Wang and Guojun Zhang
055	**Poster# 425**	**Paper Title:** Biomimetic Lateral-Line-Inspired AlN Piezoelectric Cilium MEMS Vector Hydrophone **Authors:** Yujia Chai, Guojun Zhang, Renxin Wang, Jiangong Cui, Chenbin Ma, Yuhua Yang, Changde He, Wendong Zhang and Licheng Jia
056	**Poster# 426**	**Paper Title:** Development of a MEMS Hydrophone Based on AlN/$Sc_{0.2}Al_{0.8}N$ Piezoelectric Composite Thin Films **Authors:** Zhenyao Shi, Chenbin Ma, Guojun Zhang, Yuhua Yang, Jiangong Cui, Changde He, Renxin Wang, Wendong Zhang and Licheng Jia

057	**Poster# 427**	**Paper Title:** Design and Characterization of a Pressure-Resistant MEMS Hydroacoustic Sensor Based on Piezoelectric Composite Films **Authors:** Yuanyuan Wei, Chenbin Ma, Guojun Zhang, Yuhua Yang, Jiangong Cui, Changde He, Renxin Wang, Wendong Zhang and Licheng Jia

Poster Sessions

Poster Session 03

15:00-17:00, April 18-20, 2026 **Poster Area - 3F**

Order	Paper ID	Details
001	**Poster# 29**	**Paper Title:** Research on Magnetic-Field-Regulated Embedded 4D Printing **Authors:** Liang Zhou, Xiaosheng Zhang and Yi Zhang
002	**Poster# 30**	**Paper Title:** Flexible Pressure Sensor with Biomimetic Microstructure Based on Digital Light Processing **Authors:** Xiaomeng Yang, Xiaosheng Zhang and Yi Zhang
003	**Poster# 42**	**Paper Title:** Flexible Mechanically Adaptive Microneedle Electrodes for Neural Signal Recording **Authors:** Chen Zheng Zhou, Guang Yao and Yuan Lin
004	**Poster# 72**	**Paper Title:** Deep Learning – Enabled Grasped Object Recognition Using a Dual-Mode Triboelectric Tactile Sensor **Authors:** Yating Xie, Jiaxuan Wu, Guangshuai Bao and Bo Meng
005	**Poster# 80**	**Paper Title:** A Silk Fibroin Hydrogel-Based Ultra-Thin Transparent Multifunctional Health Monitoring Sensor **Authors:** Shuhao Cui, Yu Qiu, Haitao Deng and Xiaosheng Zhang
006	**Poster# 81**	**Paper Title:** Biocompatible Silk Fibroin All-Fiber Sensor Toward Smart Textile Applications **Authors:** Wei Li, Dan-Liang Wen, Hao Zheng and Xiaosheng Zhang
007	**Poster# 82**	**Paper Title:** Enhancing Temperature Stability Based Silicon Microring Resonator Thermometers With Higher Quality Factor **Authors:** Fei Wang, Hua Xiao, Zude Lin, Jingquan Liu and Minmin You
008	**Poster# 95**	**Paper Title:** Low-Power Cantilever-Type MEMS PdAu Hydrogen Sensor **Authors:** Ruihao Wang, Xiaoqi Feng, Xing Zhang, Tengfei Li, Weiwen Zhang and Hairong Wang
009	**Poster# 102**	**Paper Title:** A Mems Pressuresensor Based on Membrane Stress Modulation **Authors:** Tongying Xing, Cheng Tu, Yu Chen and Xiaosheng Zhang
010	**Poster# 104**	**Paper Title:** A High Sensitivity High Stability Resonant Differential Pressure Sensor Based on Si-Si Bonding **Authors:** Xingyu Li, Wenliang Xia, Bowen Tan, Bo Xie, Junbo Wang and Deyong Chen
011	**Poster# 107**	**Paper Title:** Ultra-Broadband Millimeter-Wave Absorber via 3D-Printed Ceramic-Matrix Composite Metamaterial Architectures

		Authors: Ji Hu, Xiaosheng Zhang and Yi Zhang
012	**Poster# 121**	**Paper Title:** Laser-Enabled Conductive Circuit Patterning for Wearable E-Textiles **Authors:** Ruyu Pu, Yuheng Chang, Xingming Wen, Ziang Cui and Ze Xiong
013	**Poster# 129**	**Paper Title:** Pyramidal Silicon Nanopores for Real-Time Single Molecule Characterization **Authors:** Ho Pui Ho, Dehua Hu, Jianxin Yang, Tianle Pan, Wu Yuan and Qingyue Dong
014	**Poster# 133**	**Paper Title:** Solution-Processed Ag2Te Photoconductors for Broadband Photodetection **Authors:** Liying Cao, Weiyue Kong, Heng Tang, Tianlei Ma, Shuhan Zhang, Min Tu and Fu Li
015	**Poster# 136**	**Paper Title:** Towards a Novel Piezoelectric Mems Loudspeaker Exploiting Sound Pressure Level Superposition **Authors:** Fengzhe Xu and Yuan Wang
016	**Poster# 142**	**Paper Title:** Functionalization of CMUTs-based SO2 sensor with Electrospun Metal-organic Framework for controllable Nano-scale Structure and Uniformity **Authors:** Tong Wang, Yihe Zhao, Zhikang Li, Jiawei Yuan, Shaohui Qin, Shiwang Zhang, Boqing Jia, Zimeng Zhang, Daren An, Jie Li, Min Li and Libo Zhao
017	**Poster# 144**	**Paper Title:** Fast-Response Pyroelectric Devices Based on Suspended Lithium Niobate Single-Crystal Thin Film Arrays **Authors:** Yuqing Hu, Qing Wan and Xianhao Le
018	**Poster# 148**	**Paper Title:** A Three-Axis Force Tactile Sensor Based on Optical Pinhole Imaging **Authors:** Guangshuai Bao, Yijun Li, Jiaxuan Wu and Bo Meng
019	**Poster# 160**	**Paper Title:** Study of Out-of-Plane Vibration Performance in Comb-finger Accelerometers **Authors:** Shuaimin Wang, Yuzhao Wang, Guoliang Sun, Haobin Niu, Lin Teng and Hua Li
020	**Poster# 161**	**Paper Title:** A Silicon-based MEMS Inertial Switch Capable of Stable Locking **Authors:** Baolin Cheng, Weirong Nie, Mo Yang, Yun Cao, Zhanwen Xi and Junlin Lu
021	**Poster# 162**	**Paper Title:** A Pyramidal Microwell Array-Based Liquid Crystal Platform for Label-Free Chemical Sensing **Authors:** Zitong Ye, Jiahua Zhong, Qinghao He, Jie Zhou, Xinyi Chen and Weijin Guo
022	**Poster# 163**	**Paper Title:** Local Resonance Propulsion of Millimeter-Scale Magnetic Micro-Robots Is Achieved Through Magnetic Field Mode Conversion **Authors:** Sun Haoyi, Zhang Xiaosheng and Zhang Yi
023	**Poster# 176**	**Paper Title:** A Lightweight Deep Learning Approach for Thermal Compensation in Resonant MEMS Electric Field Sensors **Authors:** Jun-Jie Wang, Hao-Dong Zhang, Zai-Fa Zhou and Zheng-Wei Wu

024	**Poster# 179**	**Paper Title:** Monolithically Integrated High-Resolution Tactile Pixel Arrays Based on Vertical ZnO Nanowires Embedded in PVDF **Authors:** Wenhui Li, Zhenni Huang, Shitao Lou, Shenyong Yang and Siyu Liu
025	**Poster# 188**	**Paper Title:** Performance Optimization of Piezoelectric MEMS Accelerometers through Proof Mass Shape Design **Authors:** Wenjun Xu, Yuancheng Ouyang, Yuan Xie, Meiying Li, Guojian Ding, Yang Wang, Pingjuan Niu and Haiqiang Jia
026	**Poster# 197**	**Paper Title:** Asymmetric Van der Waals Contact Engineering for Tunable Carrier Transport in MoS_2 Transistors **Authors:** Mingdi Zhang, Ziying Hu, Shijie Zhao, Zeming Jin, Xia Liu and Yeliang Wang
027	**Poster# 208**	**Paper Title:** Tensile Interlocking Mechanical Metamaterials Enabled by Grayscale DLP Printing **Authors:** Liying Zhang, Min Gao, Taisong Pan, Guang Yao and Yuan Lin
028	**Poster# 219**	**Paper Title:** Study of a Thin Film NTC Thermistor **Authors:** Changming Dai, Tianzheng Xie, Zeyu Cui, Chuangdong Liu, Ying Zhang and Hang Guo
029	**Poster# 224**	**Paper Title:** TPMS-Based 3D-Printed Porous Tantalum Scaffolds Promote Osteogenic Differentiation of BMSCs and Achieve Superior In Vivo Osseointegration **Authors:** Mengxiao Tantai, Yi Zhang and Zhidong Lu
030	**Poster# 252**	**Paper Title:** Detection of R454B Refrigerant Gas Using Au-Modified SnO2 nanomaterial **Authors:** Zhi Chen, Ziqi Luo, Haoqing Li and Fei Wang
031	**Poster# 258**	**Paper Title:** A Non-Invasive DC Current Sensor with a Passive Wireless Sensing Scheme **Authors:** Yifan Fang, Takahito Ono and Dong F. Wang
032	**Poster# 271**	**Paper Title:** Research on an Electrostatic Tuning Method for Suppressing Stiffness Coupling Error of the MEMS Butterfly Gyroscope **Authors:** Yunbin Kuang, Xiaoyan Huo, Xiongkai Zhao, Kai Zhou, Leiping Xi, Weiran Duan, Fengming Shi, Jie Liu and Yongjiang Hu
033	**Poster# 275**	**Paper Title:** Investigation of A New Thin Film Thermocouple Based on ZnO/Pt Junction **Authors:** Zeyu Cui, Changming Dai, Kaiyu Zhang, Dingyuan Guo, Ying Zhang and Hang Guo
034	**Poster# 282**	**Paper Title:** Investigation of Sample Volume Effect on Viscosity Sensor Using SAW Devices **Authors:** Junaid Waheed, Yang Ye, Anjam Waheed, Tsunemasa Saiki, Kenji Sakamoto, Satoshi Amaya, Riyanarto Sarno, Tadao Matsunaga and Sang-Seok Lee
035	**Poster# 290**	**Paper Title:** Research on a Stiffness Pre-programmable Flexible Actuator Based on

		Electrostatic Hydraulics **Authors:** Jiemin Yao, Yimu Zhang, Wenyang Yu, Yin He, Xinyao Peng and Kai Tao
036	**Poster# 317**	**Paper Title:** Flexible Capacitive Pressure Sensor Based on Microstructured MWCNTs/PDMS Composite Dielectric **Authors:** Qiming Xie, He Zhang, Shufan Li, Huatan Chen, Wenwang Li and Xiang Wang
037	**Poster# 321**	**Paper Title:** Butterfly-Inspired Soft Flapping-Wing Robot Driven by Electro-Hydraulic Coupling **Authors:** Ying He, Yuxi Li, Ziyu Zhang, Chunjiao Wang, Yuwen Zhang and Kai Tao
038	**Poster# 322**	**Paper Title:** Prediction and Fabrication of Glass Reflow Process in TGV for 3D Wafer-Level Vacuum Packaging Based on PSO-BP Algorithm **Authors:** Kai Zhou, Jie Liu, Xiaoyan Huo, Guang Yang, Xiaoguang Liu, Ping Zhou, Yijie Zheng, Yunbin Kuang and Yongjiang Hu
039	**Poster# 348**	**Paper Title:** Design of a CMUT Structure Enhanced by ALD High-κ HfO2 and the LOCOS Process **Authors:** Lei Ren, Jiandong Shen, Tianhao Yan, Wangyang Zhang, Xianglong Chen, Endian Cui, Ke Zhu, Jin Xie and Xiaojing Mu
040	**Poster# 374**	**Paper Title:** Numerical Simulation on Flameproof Performance of the Explosion-proof Component in the Detonation Wave-based Micro-explosive Train **Authors:** Yichen Chai, Hengzhen Feng, Changqi Qu, Wenzhong Lou, Lu Wang and Sining Lv
041	**Poster# 375**	**Paper Title:** Simulation Study and Analysis of Influencing Factors of Flyer Driven by Micro-Charge **Authors:** Lu Wang, Wenzhong Lou, Hengzhen Feng and Wenxing Kan
042	**Poster# 386**	**Paper Title:** Construction and Performance Study of a Personalized Nasal Cartilage Regeneration Scaffold Based on FDM-MEW Multi-Level Composite Structure **Authors:** Meng Ma, Yi Zhang, Qi Zhu, Maling Gou, Jing Yang and Xiaosheng Zhang
043	**Poster# 389**	**Paper Title:** Task-Oriented Sensitivity Customization of Crack-Based Flexible Sensors for Similar-Object Robotic Grasp Recognition **Authors:** Chenbo Wu, Lang Wang and Liaoyong Wen
044	**Poster# 397**	**Paper Title:** Removing Hard/Soft Defects on Photomasks for Semiconductor Chip Manufacturing Using Nanorobots **Authors:** Yichen Wang, Yuxuan Xue, Xiao Luo, Liang Ma, Xinyu Liu and Ning Xi
045	**Poster# 400**	**Paper Title:** Research on Etching High Aspect Ratio Microchannels by Active Oxide Layer Reset **Authors:** Yingwen Li, Xiaoyu Su, Kai Tao and Liangxing Hu
046	**Poster# 401**	**Paper Title:** Frequency Tuning of an Ultrathin Gold Nanomechanical Resonator via Controlled Gold-on-Gold Deposition **Authors:** Zihao Hou, Huining Peng, Jiaqi Wu, Bo Xu, Zenghui Wang and Jiankai Zhu

047	**Poster# 428**	**Paper Title:** Ultrasonic Detection System for Concentration-Temperature of mPEG2000 Aqueous Solution Based on ScAlN PMUT **Authors:** Yuhao Shan, Chenbin Ma, Guojun Zhang, Yuhua Yang, Jiangong Cui, Changde He, Renxin Wang, Wendong Zhang and Licheng Jia
048	**Poster# 429**	**Paper Title:** High-Precision Online Monitoring of Propylene Glycol Concentration Using a Miniaturized ScAlN PMUT Array **Authors:** Xiaoman Zheng, Chenbin Ma, Guojun Zhang, Renxin Wang, Wangdong Zhang, Yuhua Yang, Jiangong Cui, Changde He and Licheng Jia
049	**Poster# 78**	**Paper Title:** A Miniaturized UOPs-Enabled Centrifugal Microfluidic System for Multiplex Immunoassays **Authors:** Yuxing Shi and Jiuchuan Guo
050	**Poster# 417**	**Paper Title:** Design and Performance Analysis of a Vibration-Resistant MEMS Vector Hydrophone with Circular Inner Frame **Authors:** Haoxuan Li, Renxin Wang, Guojun Zhang, Jiangong Cui, Yuhua Yang, Changde He, Licheng Jia, Chenbin Ma, Wenshu Dai and Wendong Zhang
051	**Poster# 402**	**Paper Title:** Printed Wearable Multi-Sensor Fusion Thermoelectric Generator **Authors:** Ruo-Chen Zhan, Dan-Liang Wen, Hai-Tao Deng, Xiao-Sheng Zhang

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