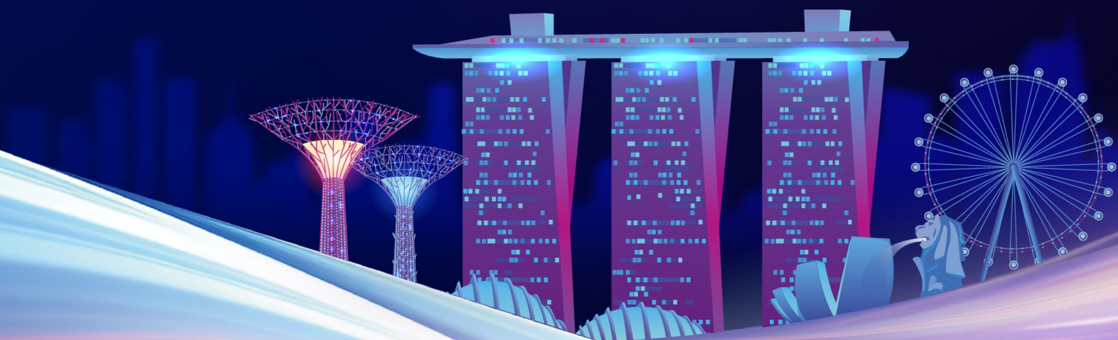
APC 2026
Asia Photonics Conference

Asia Photonics Conference

February 04-06, 2026 | Singapore

Conference Program



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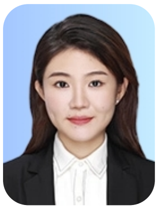

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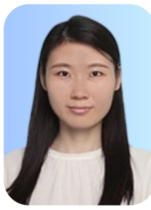

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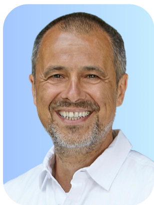
Invited Talks



Boris Mizaikoff
Ulm University

Cheng Zhang
Huazhong University of Science and Technology

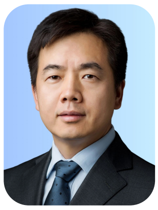
Christina Lim
The University of Melbourne

Elaine Wong
The University of Melbourne

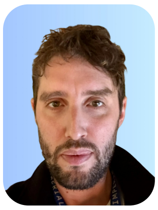
Jingwen Ma
The University of Hong Kong

Jinyu Mo
POET Technologies

Longqing Cong
Southern University of Science and Technology



Qihua Xiong
Tsinghua University



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Imperial College London

Renmin Ma
Peking University

Wei Li
Changchun Institute of Optics, Fine Mechanics and Physics, CAS

Xiaoke Yi
University of Sydney

Yongquan Zeng
Wuhan University

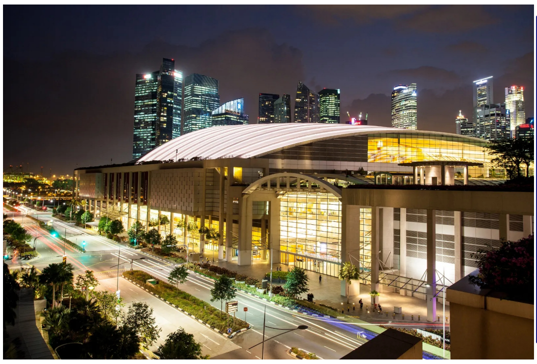
Yu-Cheng Chen
Nanyang Technological University

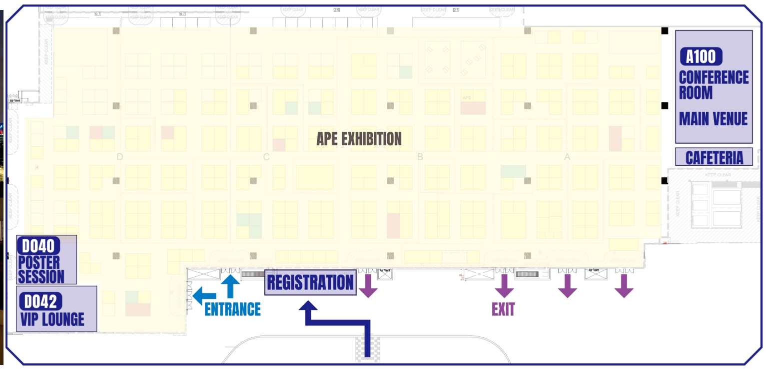
Yuh-Renn Wu
National Taiwan University

Conference Venue

Sands Expo and Convention Centre, Singapore

Address: Address: 10 Bayfront Avenue, Singapore 018956





Transportation

MRT

Sands Expo and Convention Centre Singapore is located at Bayfront MRT station (CE1/DT16). The station connects to the Circle and Downtown Line of Singapore's Mass Rapid Transit (MRT) train system.

MRT services to/from Bayfront MRT station operate daily from approximately 6am to 12am midnight.

MRT Exits:

- Exit C & D: Sands Expo & Convention Centre (3-minute walk)
- Exit E: Sands Expo & Convention Centre

CAR & TAXI

Pick-Up/Drop-Off Points:

Outside Sands Expo & Convention Centre

Car Park Entrance

Bayfront Link, next to Sands Expo & Convention Centre (South Entrance)

Conference Agenda

February 4, 2026		
Time	**Activities**	**Venue**
10:00 - 18:00	Sign-in & Conference Materials Collection	Sands Expo & Convention Centre (Marina Bay Sands) Level 1, Registration
Opening Ceremony EMCEE: Daiqi Xiong, Hangzhou International Innovation Institute, Beihang University, China		
10:50 - 10:55	***Opening Remarks*** Perry Ping Shum, The 37th President of IEEE Photonics Society	Conference Room (A100)
10:55 - 11:00	***Award Ceremony***	
Plenary Speech 1 Presider: Qijie Wang, Nanyang Technological University, Singapore		
11:00 - 11:35	***Optical PCle/CXL Interconnect for Remote GPU, Accelerator, and Memory Expansion*** C. Patrick Yue, The Hong Kong University of Science and Technology, China	Conference Room (A100)
Plenary Speech 2 Presider: Di Zhu, National University of Singapore, Singapore		
11:35 - 12:10	***Harvesting Excitons in Flatlands for Quantum Photonics*** Goki Eda, National University of Singapore, Singapore	Conference Room (A100)

February 5, 2026		
Time	**Activities**	**Venue**
10:00 - 10:30	APE Exhibition	Sands Expo & Convention Centre (Marina Bay Sands) Level 1
16:00 - 17:00	Poster Session	D040
17:00 - 18:00	VIP Lounge open for networking	D042

February 6, 2026		
Time	**Activities**	**Venue**
10:20 - 12:00	Session 1: Laser Technology & Optical Communication and Networks & Integrated Photonics	Conference Room (A100)
13:30 - 14:50	Session 2: Nanophotonics	
14:55 - 15:55	Session 3: Nanophotonics & Biophotonics & Integrated Photonics	
16:00 - 17:00	Session 4: Optical Sensing and Measurement & Optoelectronic Devices and Applications	

Plenary Speakers

Time: 11:00-11:35 Venue: Conference Room (A100)

C. Patrick Yue

The Hong Kong University of Science and Technology, China

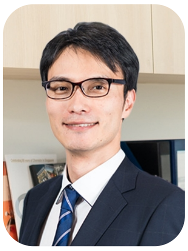
Bio.: Prof. Yue received his BSEE from UT Austin, his Master and PhD degrees in EE from Stanford in 1994 and 1998, respectively. He has cofounded a few startups in Silicon Valley and Hong Kong, including Atheros Communications (1998), Jetcomm Technologies (2014), LiPHY Communications (2019), AIoTR Academy (2021), and High5 Semiconductor (2024) to commercialize and transfer technologies from academic to industry. He has been a professor for over two decades and has taught IC design courses and conduct research at Carnegie Mellon (2003-06), UC Santa Barbara (2006-11), Tsinghua (2015-16), HKUST (2010-now), and Stanford (1998 & 2025). He has supervised over 10 post-docs, 30 PhD and 10 MPhil student. He has published over 250 technical papers and holds over 25 patents. Together with his students and teachers, he has won a number of awards including the IEEE VLSI Circuit Symposium Test of Time Award (2024), the IEEE Circuits and Systems Society Outstanding Young Author Award (2017), and the Guanghua Engineering Science and Technology Youth Award by the Chinese Academy of Engineering (2016), and the ISSCC Best Student Paper Award (2003). Prof. Yue is a Fellow of the IEEE and Optica.
His current research interests spans over a few diverse areas including optical wireline and mmWave wireless integrated circuits, 3D computer vision models, and smart power network management system.

Optical PCIe/CXL Interconnect for Remote GPU, Accelerator, and Memory Expansion

Abstract: Modern Gigabit Ethernet links deliver extremely high throughput—ranging from 100 Gb/s to 800 Gb/s and rapidly progressing toward terabit-class transmission—and have long integrated optical technologies through standardized optical PHYs and pluggable transceivers. As a result, Ethernet provides fiber-based server-to-server connectivity over rack-scale distances. Although Ethernet offers extremely high bandwidth and excellent scalability, it is fundamentally designed as a packet-switched network fabric rather than a device-level interconnect. Using Ethernet to attach tightly coupled resources such as GPUs, NVMe SSDs, or CXL memory would introduce unnecessary networking overhead and complexity, providing far more functionality than these device interfaces require. By contrast, PCIe is developed for direct load/store access, deterministic timing, and sub-100-ns latency. These properties make PCIe the foundational interconnect for GPUs, high-speed storage, SmartNICs, and CXL-based memory expansion. However, PCIe's physical layer is restricted to short-reach electrical signaling over copper, which suffers from frequency-dependent attenuation, impedance discontinuities, and strong crosstalk at multi-gigahertz data rates. Optical fiber, by contrast, offers much lower loss and nearly flat bandwidth over tens of meters, making it inherently superior for long-reach high-speed transmission.
This contrast creates a fundamental architectural gap: Ethernet provides optical reach but lacks the memory semantics required for device-level attachment, whereas PCIe provides the correct semantics but lacks optical reach.Bridging this gap requires transporting native PCIe/CXL traffic over optical fiber without altering software, firmware,link-training behavior, or sideband signaling.
Motivated by this need, we demonstrate a fully optical PCIe/CXL interconnect prototype that extends GPU,accelerator, and storage devices over more than 50 meters of multimode fiber. The system preserves native PCIe/CXL semantics and operates without hardware, firmware, or software changes, enabling practical rack-scale disaggregation for future AI and cloud computing architecture The talk takes a light hearted look at the past and imagines the future.

Plenary Speakers

Time: 11:35-12:10 Venue: Conference Room (A100)



Goki Eda

National University of Singapore, Singapore

Bio.: Dr. Eda is Associate Professor of Physics and Chemistry at the National University of Singapore, and a member of the Centre for Advanced 2D Materials (CA2DM). Before joining NUS in 20211, he was a Newton International Fellow of the Royal Society of the UK and worked at Imperial College London. Dr. Eda received his M.Sc. in Materials Science and Engineering from Worcester Polytechnic Institute in 2006 and Ph.D. in the same discipline from Rutgers University in 2009. He is a recipient of the Singapore National Research Foundation (NRF) Research Fellowship and many awards including the Singapore National Academy of Science (SNAS) Young Scientist Award and University Young Researcher Award. He is an Associate Editor of npj 2D Materials and Applications. His research focuses on leveraging the quantum phenomena of two-dimensional materials for applications in electronic, optoelectronic, and spintronic devices.

Harvesting Excitons in Flatlands for Quantum Photonics

Abstract: Some of the strongest light–matter interactions in semiconductors arise not in bulk crystals, but in materials with reduced dimensionality. Two-dimensional (2D) semiconductors such as monolayer MoS2 and WSe2 absorb and emit light far more efficiently than their bulk counterparts. This behavior is governed by excitons – tightly bound electron–hole pairs that dominate light–matter coupling in these systems. Owing to reduced dielectric screening, excitons in 2D semiconductors are bound much more strongly than in conventional semiconductors, allowing them to remain stable even at room temperature and making 2D materials a promising platform for a wide range of photonic technologies.

Over the past decade, intense research into the excitonic properties of 2D semiconductors has led to a series of notable discoveries. In this talk, I will trace this journey – from early studies that revealed the fundamental optical properties of monolayer semiconductors to recent advances in devices and quantum light sources [1]. Along the way, I will highlight several examples from our group that illustrate how unusual physical phenomena emerge when excitonic 2D materials are combined with nanoscale structures and careful materials engineering. These include upconversion electroluminescence in plasmonic tunnel junctions [2]; single-photon emission arising from impurity-bound exciton complexes [3]; and exciton-enhanced nonlinear photovoltaic effects [4].

Together, these examples show how controlling excitons – through geometry, chemistry, and local environment – opens new opportunities for optoelectronic and quantum photonic applications. I will conclude with a brief outlook, discussing how symmetry engineering and interfacial ferroelectricity may offer additional knobs for shaping light–matter interactions in 2D semiconductors, and for pushing these materials toward new device concepts.

[1]Loh et al. "Towards quantum light-emitting devices based on van der Waals materials" Nat. Rev. Elec. Eng. 1, 815 (2024)

[2]Wang et al. "Upconversion electroluminescence in 2D semiconductors integrated with plasmonic tunnel junctions" Nature Nanotech. (2024)

[3]Loh et al. "Nb impurity-bound excitons as quantum emitters in monolayer WS2" Nature Comm. 15, 10035 (2024)

[4]Chen et al. "Excitonic shift current in monolayer MoS2" Under Review.

Technical Sessions

Session 1: Laser Technology & Optical Communication and Networks & Integrated Photonics	
Time: 10:20-12:00, February 6, 2026	**Venue: Conference Room (A100)**
Session Chairs:	**Lennon Lee, Paeonia Innovations, Singapore;** **Jinyu Mo, POET Technologies, Singapore**
Invited Talks	
10:20-10:40	***Mid-infrared Laser Ablation for Sub-cellular Metabolomic Imaging*** **Abstract:** Mass spectrometry imaging (MSI) is emerging as a transformative technique for spatial biology, multi-omics, and clinical pathology. Unlike traditional optical microscopy, which visualizes cells and tissues with photons, MSI creates images from molecules themselves by measuring their mass-to-charge ratios with mass spectrometry. This shift from photons to molecules provides a powerful new view of biology but also raises fundamental challenges at the interface of analytical chemistry and photonics. In this talk, I will discuss how specifically engineered infrared laser sources, tuned to vibrational resonances such as the O–H stretch at 2.94 μm, can be engineered as precise ablation sources for MSI. By controlling wavelength, pulse duration, and fluence, we have demonstrated imaging at sub-cellular ‘resolutions’ (2 μm pixels) with enhanced molecular sensitivity, and directly visualized how plume dynamics govern the ion signal captured in the mass spectrometer. **Robert Murray, Imperial College London. United Kingdom** **Bio.:** Dr Robbie Murray is Associate Professor in Mid-Infrared Photonics at Imperial College London, where he leads a research team developing next-generation mid-infrared light sources for applications in biomedicine and security. His research combines nonlinear optics, ultrafast laser physics, and analytical chemistry to create novel mid-infrared laser sources and advanced mass spectrometry imaging platforms. Recent highlights include the demonstration of subcellular-resolution molecular pathology using picosecond mid-IR laser ablation.
10:40-11:00	***Mid-Infrared Fiberoptic Sensors: Potential and Challenges*** **Abstract:** TBA **Boris Mizaikoff, Ulm University, Germany** **Bio.:** Dr. Boris Mizaikoff is a Chaired Professor and Director of the Institute of Analytical and Bioanalytical Chemistry @ Ulm University (Germany) with prior appointments at the Vienna University of Technology (Austria) and at the Georgia Institute of Technology (USA). From 2021-2025 he was also a Director at the Hahn-Schickard Institute for Microanalysis Systems in Ulm (Germany). His research interests focus on optical sensors, biosensors, and biomimetic sensors in the mid-infrared spectral range, system miniaturization and integration based on micro- and nanofabrication, multifunctional (nano)analytical platforms, development of biomolecular/biomimetic molecular recognition architectures, multivariate data evaluation, and applications in environmental analysis, process analysis, and biomedical/clinical diagnostics. He is (co)author of 500+ peer-reviewed publications and 22 patents.

11:00-11:20	***Intelligent Optical Cross-Haul Network to Support Future Wireless Communication Systems*** **Abstract:** This paper reviews recent work in optical cross-haul network focusing on the scalability and flexibility to provide intelligence to the network to seamlessly support future wireless communication network. It investigates and shows how the performance of the optical-wireless converged network can be optimized through network orchestration and dynamic network reconfiguration depending on the network and traffic demands. **Christina Lim, The University of Melbourne, Australia** **Bio.:** Christina Lim is a Professor at the Department of Electrical and Electronic Engineering at the University of Melbourne, Australia. She is also the Associate Dean of Research of the Faculty of Engineering and Information Technology (FEIT) and the Manager of Tucker Lab in the Department. She has previously served as the Research Group Leader of the Electronics and Photonics System and as the Deputy Head of Department (Teaching and Operations). Her research interests include radio-over-fibre, fibre-wireless access technology, microwave photonics, optical network architectures, optical wireless and free-space optics communications. She has co-authored more than 300 papers in leading journals and conferences. She was an elected member of the IEEE Photonics Society Board of Governors between 2015-2017 where she is currently the Vice-President of Conference of the Society. She also serves as the Deputy Editor for IEEE/Optica Journal of Lightwave Technology. She is an IEEE, Optica (previously OSA) and the Australian Academy of Technological Sciences and Engineering (ATSE) Fellow.
11:20-11:40	***Opportunities, Challenges and Emerging Solutions for Next Generation Indoor Fiber Networks*** **Abstract:** The telecommunications industry is transitioning into an experiential-oriented era, characterized by immersive technologies which demand low-latency and high-bandwidth networks. Over the past two decades, passive optical network technologies have been critical in enabling high capacity broadband access to residences and businesses. The push for fiber access technology, now heading deeper into indoor settings, will continue unabated. This talk explores the drivers, the technical challenges involved, and emerging solutions designed to ensure indoor fiber networks satisfy user experience expectations. **Elaine Wong, The University of Melbourne, Australia** **Bio.:** Professor Elaine Wong is a Redmond Barry Distinguished Professor in the Faculty of Engineering and Information Technology and Pro Vice-Chancellor (People and Equity) at the University of Melbourne. Elected as a Fellow of Optica and Fellow of Engineers Australia, Elaine is an international research leader on optical communication networks and subsystems technology, contributing to the success of broadband network deployments around the globe and impacting how society digitally connects today. She currently leads a team innovating immersive human-to-machine communications. With the goal of delivering experiential capabilities over large geographical areas, such innovation will enable humans to equitably and immersively participate in social and economic settings from afar. Elaine currently serves on the Australian Research Council College of Experts, the IEEE Technical Activities Board - Committee of Broadening Participation and Chair of the IEEE Communication

	Society Optical Network Technical Committee (ONTC). She is Technical Editor of IEEE Network and General Chair of Optical Fiber Communication Conference (OFC) 2025. In the past, such served as an elected member of the IEEE Photonics Society Board of Governors and its Publications Council. Elaine has also contributed extensively to numerous IEEE conferences, serving in key roles General Chair, Technical Program Committee (TPC) Chair, and TPC member. Additionally, she has served on many editorial boards, including that of the IEEE/Optica Journal of Optical Communications and Networking as well as the IEEE/Optica Journal of Lightwave Technology.
11:40-12:00	***Photonics Hybrid Integration Technology Platform: Optical Interposer*** **Abstract:** Rising bandwidth and power demands in data-centers and high-performance computing systems are accelerating the adoption of optical interconnects beyond traditional pluggable solutions. Optical interposers provide a practical platform for hybrid integration of photonic and electronic components within advanced packages. This talk presents an industry-oriented hybrid integration technology platform based on an optical interposer, enabling scalable assembly of optical engines and electronic ICs. The platform integrates low-loss passive waveguides, high-precision optical coupling structures, and robust electrical interfaces to support data rates of 200G per lane and beyond. Key manufacturing considerations—including optical alignment tolerance, thermal management, and assembly scalability—are addressed. Measured results demonstrate competitive optical loss, bandwidth density, and thermal stability, highlighting the optical interposer as a manufacturable and cost-effective solution for next-generation data centers and co-packaged optic applications and chiplet-based systems. **Jinyu Mo, POET Technologies, Singapore** **Bio.:** Dr. Mo is a highly experienced technical and business veteran of the photonics and optoelectronics industries. Her expertise covers optical transmission system, advanced optical modulation format, tunable semiconductor lasers, DFB & FP lasers and PD/APD, optical transceiver modules and high-speed integrated packaging. Dr. Mo has more than 25 years of experience spanning several companies, including MACOM Technology Solutions as CTO in Asia and Shenzhen GM, Bookham/ Oclaro as Senior R&D Director, Huawei as Technical Expert, I2R in Singapore and Nexvave Photonics Technology Co., which she founded and served as Chief Technology Officer. Dr. Mo is now with POET Technologies as the Senior Vice President, General Manager of Asia. Dr. Mo received her PhD degree in Optical Communications from Nanyang Technological University (NTU) Singapore. She is a Senior member of IEEE and has been a member of IEEE's Technical Committees for several international conferences.

Session 2: Nanophotonics

Time: 13:30-14:50, February 6, 2026	Venue: Conference Room (A100)
Session Chairs:	**Zhenggang Lian, Yangtze Optical Electronics Co. LTD., China; Dongmei Huang, The Hong Kong Polytechnic University, China**

Invited Talks

13:30-13:50	***Metasurface-enabled Multi-functional Imaging*** **Abstract:** Metasurfaces are planar arrays of subwavelength electromagnetic structures that collectively mimic the functionality of much thicker conventional optical elements, and are considered as promising solutions for various advanced imaging applications. In this talk, I will present our recent efforts of implementing all-optical differentiators using dielectric metalenses, which perform spin-multiplexed arbitrary-order differential operations over the light field of the imaging scene, and their applications in label-free biological imaging and pathological analysis. **Cheng Zhang, Huazhong University of Science and Technology, China** **Bio.:** Cheng Zhang is a professor at School of Optical and Electronic Information & Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology. He obtained his BS degree in electrical science and technology from Shandong University, China, in 2010, and his PhD in electrical engineering from the University of Michigan, Ann Arbor, United States, in 2016. He currently leads a research team working on cutting-edge projects aimed at the exploitation of nanophotonic materials, devices and fabrication techniques for novel imaging and displaying applications (https://light.hust.edu.cn).
13:50-14:10	***Narwhal Wavefunction and the Quest for Ultimate Light Confinement*** **Abstract:** Plasmonics has revealed the power of light confinement beyond the diffraction limit, inspiring breakthroughs across physics, chemistry, and biology. Yet dielectric systems were long believed to lack such capability. In this talk, we introduce the narwhal wavefunction that establishes a lossless dielectric pathway beyond the optical diffraction limit. Rooted in the singular dispersion equation, it unifies exponential decay with power-law enhancement, enabling extreme, dissipation-free light confinement. This advance opens a new regime of atomic-scale field localization and points toward transformative opportunities in nanophotonics, quantum optics, and high-resolution optical imaging. **Ren-Min Ma, Peking University, China** **Bio.:** Ren-Min Ma is a Boya Distinguished Professor and Vice Dean of the School of Physics at Peking University. His research focuses on micro- and nanolaser physics and light–matter interactions at extreme scales. He verified the performance advantage of plasmonic nanolasers, realized reconfigurable moiré nanolaser arrays, and proposed the singular dispersion equation enabling lossless, sub-diffraction confinement in dielectric systems. He has published in Science, Nature, and related journals with over 10,000 citations. His work was recognized among China' s Top Ten Scientific Advances (2024) and honored with the Xplorer Prize and Wang Daheng Optics Award.

14:10-14:30	***High-performance Topological Photonic Crystal Lasers*** **Abstract:** The concept of topological photonics has renovated the design of semiconductor lasers. Its integration with photonic crystals leads to the development of various novel lasers. However, most of the prior work concentrated on the demo of concepts. How to utilize the new degrees of freedom for better performance requires further study. In this presentation, I will talk about our recent progress of topological photonic crystal lasers by exploring diverse design freedoms to tailor the emission performance. By expanding the topological interface as well as mode volume of edge states, we realized low-threshold and high-power surface-emitting lasers. By harnessing the synthetic dimension freedom in photonic crystal, we demonstrate a broadband nano-rainbow lasing with low threshold, large spontaneous emission factor (β), and milliwatt output power. In addition, we unveil the physical limitation for achieving high linear polarization from a surface-emitting photonic crystal lasers and propose a beam-polarization matching strategy to realize high-purity linearly polarized laser with a good beam emission quality from a compact footprint. **Yongquan Zeng, Wuhan University, China** **Bio.:** Zeng Yongquan, a professor at Electronic Information School, Wuhan University. He graduated with a bachelor's degree from the Department of Materials Physics at the University of Science and Technology of China, and obtained his doctoral degree from School of Electrical and Electronic Engineering at Nanyang Technological University in Singapore. He has been engaged in the research of novel semiconductor lasers for more than 12 years, accumulating rich research experience in the functional design of semiconductor lasers, optimization of photonic structures, experimental preparation and performance characterization. He has led and participated in several scientific research projects including the National Key Research and Development Program, the National Natural Science Foundation of China, and the Innovation Program of Hubei Province. Currently, he has published over 40 SCI papers in journals such as Nature, Nat. Commun., Sci. Adv., Nano Lett., Adv. Opt. Mater., ACS Photon., etc. As a key contributor, he has published 2 papers in Science. In addition, he has applied for 15 international/domestic patents and has 2 patents granted; he has given over 20 invited presentations at international and domestic conferences.
14:30-14:50	**Exciton-polaritons: Exotic Light Manipulation and Macroscopic Quantum Phases** **Abstract:** Light－matter interactions at the nanoscale provides endless possibilities for building a new generation of photonic chips and devices. This talk will focus on our two recent research advances. By exploring novel magnetic quantum materials, we report the first negative refraction mediated by excitons. Interestingly, we found that this phenomenon can be controlled by intrinsic magnetic orders, opening up new possibilities for utilizing magnetic excitons for nanoscale light manipulation. By heterogeneously integrating excitonic materials with nano-photonic-crystals, we have achieved a quantum solid, i.e., supersolid, that can exhibit both diagonal and off-diagonal long-range order at room temperature. This discovery opens the gate to exploring exotic macroscopic quantum coherence states at room temperatures. **Jingwen Ma, The University of Hong Kong, China** **Bio.:** Jingwen Ma is a Research Assistant Professor at the University of Hong Kong (HKU), working on strong light-matter interactions between photonic nanostructures and

	organic/inorganic semiconductors. His first-author/corresponding-author research has been published in Nature Nanotechnology, Nature Comunication, Science Advances, Light & Science Applications, and so on. His current research focuses on nano-photonic devices and chips, where he studies interactions of light with novel nanostructures and nanomaterials, aiming to discover exotic optical phenomena not found in nature and create innovative nano-devices for next-generation photonic chips.

Session 3: Nanophotonics & Biophotonics & Integrated Photonics	
Time: 14:55-15:55, February 6, 2026	**Venue: Conference Room (A100)**
Session Chairs:	**Dora Juan Juan Hu, Agency for Science, Technology and Research (A*STAR), Singapore;** **Zhengji Xu, Sun Yat-sen University, China**

Invited Talks	
14:55-15:15	***Microwave Photonic Signal Processing and Sensing*** **Abstract:** TBA **Xiaoke Yi, University of Sydney, Australia** **Bio.:** Xiaoke Yi received the Ph.D. degree from Nanyang Technological University, Singapore. She is currently a Professor with the School of Electrical and Computer Engineering at the University of Sydney, Australia. She was the First Cohort of Sydney Research Accelerator Fellow and an Australian Research Council QEII Fellow. She was awarded Engineers Australia's Most Innovative Engineers award and the Bradfield Award for exceptional engineering merit. Her main research interests include microwave photonics, sensors, photonic integrated circuits, and photonic signal processing.
15:15-15:35	***Manipulating Exciton Polariton Condensates and Their Ultrafast Dynamics Towards Room-Temperature Polaritonics*** **Abstract:** Optical microcavities are photonic structures that confine light within wavelength-scale volumes, such as distributed Bragg reflectors, photonic crystals, microspheres, or ring resonators. They offer versatile platform to investigate and manipulate light-matter interactions. In the weak-coupling regime, the spontaneous emission rate will be modulated by the Purcell effect, facilitating technological applications in low-threshold lasers, efficient nonlinear processes, and ultra-sensitive biosensors. In the strong-coupling regime, a quantum superposition between photonic state and matter-wave excitation will be resulted, enabling diverse quantum information applications. In this talk, we will discuss our recent effort in manipulating exciton polariton condensates at room temperature in halide perovskite or two-dimensional semiconductor microcavities. We discuss how we can use optical lattices to engineer the strong optical responses including topological properties, and their ultrafast propagation. Finally, we will briefly discuss the strong nonlinear interactions in polaritons which drives coherent long-range propagation, manifested as optical spin Hall effect and ultrafast functional polaritonic devices. The future directions towards room-temperature polaritonics will be discussed in a perspective way.

	Qihua Xiong, Tsinghua University, China **Bio.:** Qihua Xiong, Professor of Physics and Associate Chair of Physics Department at Tsinghua University, New Cornerstone Investigator, APS/MRS/OSA Fellows. He started his independent career as Nanyang Assistant Professor at Nanyang Technological University in 2009, then tenured in 2014 and promoted to full professor in 2016. He relocated to Tsinghua University in 2020. He was awarded Singapore National Foundation NRF Fellowship in 2009 and NRF Investigatorship in 2014, he received Nanyang Award for Research Excellence in 2014, IPS Nanotechnology Physics Award in 2015, and IUMRS Mid-career Researcher Award in 2024. His scientific research impact was recognized by Clarivate highly cited researchers worldwide (2019-2025). His research covers a wide range of topics related to the fundamental optical processes in low-dimensional quantum materials, and their enhanced light-matter interactions in microcavities. He has published more than 370 papers in well-established journals and attracted more than 35,000 citations, with an H-index of 103. Currently, he serves as the associate editor for Nano Letters and advisory board for a number of international journals.
15:35-15:55	***Smart Lasers for Healthcare and Environment Sensing*** **Abstract:** Lasers are ubiquitous in our daily lives from industry, communication to medicine. The scale of lasers has also shrunk down to micron and nanoscales. As the scale of laser become smaller, the functions of lasers have also been redefined by transforming living biologicals and biomaterials into micro- and nanoscale lasers. Such tiny lasers could therefore be used to detect or monitor critical chemical or physical signals in living cells or human body with distinctive sensitivity and intensity. In this talk, I will introduce the recent development of functional lasers and showcase how this interdisciplinary technology bridges laser physics and biology to tackle biomedical, environment problems, and information technology. This will cover applications including sensing at multiscale of biology, tracking and monitoring, screening of food and drugs. Finally, discussion and outlook will be made on the strategies to pioneer novel on-chip laser devices for future medical diagnosis and global sensing technology. **Yu-Cheng Chen, Nanyang Technological University, Singapore** **Bio.:** Professor Chen Yu-Cheng received a PhD degree in Biomedical Engineering from the University of Michigan, Ann Arbor, USA and joined Nanyang Technological University, Singapore in 2018. He is currently serving as the Director of Center for Biodevices and Bioinformatics, and editorial board of Communications Engineering (Nature). He is the leading pioneer in the field of biological laser sensors and inventor of laser emission microscopy. His research focuses on the development of novel tiny lasers with programmable and intelligent functions for on-chip disease diagnosis, neural analysis, and healthcare, which has been highly recognized by MIT Under 35 Innovators (2021) and featured by more than 300 news outlets. He has published more than 100 journal articles and proceedings, including Nature Biomedical Engineering, Nature Communications, PNAS, Advanced Materials, ACS Nano, Optica, Nano Letters, etc. He is also recognized as the World's Top 2% Scientist in 2022-2024 and Thought Leaders by AZO Technology in 2021.

<table>
<tr><td colspan="3">Session 4: Optical Sensing and Measurement & Optoelectronic Devices and Applications</td></tr>
<tr><td colspan="2">Time: 16:00-17:00, February 6, 2026</td><td>Venue: Conference Room (A100)</td></tr>
<tr><td>Session Chairs:</td><td colspan="2">Jing Zhang, Member of IEEE Photonics Society;
Daiqi Xiong, Hangzhou International Innovation Institute, Beihang University, China</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Invited Talks</td></tr>
<tr><td>16:00-16:20</td><td colspan="2">Spatial & Frequency Dispersion Engineering for Optical Information Detection and Processing
Abstract: Light carries rich and multidimensional information, including intensity, polarization, wavelength, and spatial distribution. The ability to detect and process this information is of both fundamental scientific interest and technological significance. In this talk, I will present our recent progress in exploiting spatial and frequency dispersion in photonic systems to achieve compact and multifunctional optical information processing. First, I will discuss how spatial dispersion (nonlocality), in conjunction with frequency dispersion, can be harnessed to realize single-shot detection of light intensity, polarization, and wavelength using simple planar optical interfaces. This approach addresses challenges faced by conventional methods that rely on complex spatial or temporal integration of polarization- or wavelength-sensitive components. Pathways toward full-Stokes polarization and broadband spectral detection will also be outlined. Second, I will describe how introducing a spatial band-pass filter in momentum space enables size-selective image processing, including edge detection and real-time dynamic denoising. Such functionality can be implemented using a simple metal – dielectric – metal architecture, offering a promising route toward ultra-compact, cost-effective, and multifunctional optical image processors.
Wei Li, Changchun Institute of Optics, Fine Mechanics and Physics, CAS, China
Bio.: Wei Li is a Professor at the Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP), Chinese Academy of Sciences (CAS), where he also serves as the Director of the GPL Photonics Laboratory. Prior to joining CAS, he completed his Ph.D. at Vanderbilt University and conducted postdoctoral research at Stanford University. His research focuses on thermal photonics, nanophotonics, and their applications in next-generation energy and information technologies. He is an Optica Fellow, IOP Fellow, a Highly Cited Researcher, and a recipient of MIT Technology Review Innovators Under 35 (TR35 Asia Pacific) award and others. He currently serves as an Associate Editor of npj Nanophotonics, SPIE Spotlight and as the faculty advisor for both the Optica and IEEE Student Chapters at CIOMP, CAS.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>16:20-16:40</td><td colspan="2">Numerical Analysis on the Impact of Alloy Disorder, V-Defects on Carrier Dynamics in Nitride-Based RGB LEDs With Localized Landscape Model
Abstract: The performance of nitride-based blue, green, and red light-emitting diodes (LEDs) is intricately influenced by material and structural factors, including alloy disorder, V-defects, and dislocation-induced tail states. To rigorously analyze these disordered systems, this study employs the localized landscape model. This approach effectively incorporates strain-induced potential shifts into the effective quantum potential, enabling the rapid and accurate calculation of both emission and absorption spectra.
Based on this framework, we investigated the distinct carrier transport mechanisms across different wavelengths. In blue LEDs, carrier transport is primarily governed by random alloy</td></tr>
</table>

	fluctuations, while V-defects provide only a marginal enhancement to performance. In contrast, for green LEDs, random alloy fluctuations create significant localized pathways that reduce forward voltage and enhance injection efficiency. Similarly, V-defects play a more critical role in green LEDs by facilitating carrier injection through sidewall quantum wells, thereby mitigating polarization-induced barriers. However, in red LEDs, these mechanisms become less effective due to significantly higher polarization fields and greater band offsets, resulting in higher turn-on voltages. Furthermore, the inclusion of tail states across all devices introduces leakage currents that screen piezoelectric fields and enhance low-bias injection, yet simultaneously increase nonradiative recombination in dislocation regions, reducing IQE. This study provides a comprehensive understanding of the interplay among alloy disorder, V-defects, and tail states, offering design strategies to optimize nitride-based LEDs across the visible spectrum. **Yuh-Renn Wu, National Taiwan University** **Bio.:** Dr. Yuh-Renn Wu is a Professor in the Graduate Institute of Photonics and Optoelectronics and the Department of Electrical Engineering at National Taiwan University. His research focuses on nitride-based optoelectronic devices (InGaN/AlGaN LEDs and UV emitters), high-power and high-frequency GaN-based HEMTs, wide-bandgap semiconductor devices, carrier transport in hybrid organic – inorganic systems, and modeling of 2D-material electronic and optoelectronic devices. Dr. Wu has published over 160 journal papers, with an H-index of 41 and more than 6,000 citations. His group develops advanced multi-dimensional TCAD tools (1D/2D/3D DDCC solvers) extensively used for LED, HEMT, and 2D-material device modeling. He is the recipient of major awards including the 2025 CIEE Outstanding Electrical Engineering Professor Award, the 2023 France – Taiwan Scientific Prize, the NTU Excelsior Chair Professorship (2024 – 2026), the Ta-You Wu Memorial Award, and multiple NSTC Future Tech Awards. He served as Chair of the IEEE Photonics Society Taipei Chapter (2023 – 2024) and previously held various academic leadership roles, including Chair of the Graduate Institute of Photonics and Optoelectronics at NTU (2022 – 2025).
16:40-17:00	***High-Efficiency Active Terahertz Membrane Metasurfaces*** **Abstract:** This paper introduces a multi-point Kerker-effect membrane metasurface that merges Kerker's condition with quasi-bound states in the continuum (q-BICs). By engineering dual-mode dispersion, a high-efficiency beam deflector is demonstrated, simultaneously realizing robust parameter tolerance and narrow-linewidth resonances — two typically conflicting properties. The experiment demonstrates an absolute beam deflection efficiency exceeding 92%, with exceptional spectral and spatial selectivity, including a 4 GHz linewidth, a 2.8° divergence angle, and a quality factor of 114. Moreover, it enables 94% transmission intensity modulation under an ultralow continuous wave pump intensity of 0.5 W/cm2. **Longqing Cong, Southern University of Science and Technology, China** **Bio.:** Longqing Cong received PhD from Nanyang Technological University and performed postdoctoral research at Nanyang Technological University and the University of Pennsylvania. His research interests include terahertz photonics, metamaterials, and photonic crystals and their applications in terahertz communications, imaging, and sensing. He has published over 60

	peer-reviewed journal papers with more than 7600 citations. He serves on the editor board of the journal Ultrafast Science (Science Partner Journal), PhotoniX and Chinese Laser Press. He was awarded the gold medal of "MRS Singapore best PhD thesis" in 2018, the World's Top 2% Scientists by Elsevier, Best Young Scientist by IEEE Photonics Society, and the WuSi Medal of Shenzhen Government.

Poster Session

Poster Session	
Time: 16:00-17:00, February 5, 2026	**Venue: D042**
Session Chair: Junqiang Zhou, Heptagon Photonics Pte. Ltd., Singapore	
NO.	**Presentation**
01	***Multi-Spectral Artificial Optoelectronic Synaptic Devices for Motion Perception*** **Abstract:** Motion recognition based on vision detectors requires the synchronous encoding and processing of temporal and spatial information in wide wavebands. Here, we report the multi-waveband sensitive optoelectronic synapses performing as graded neurons for high-accuracy motion recognition and perception. Plasmonic nanostructures were designed and fabricated on MoS2 monolayers, leading to enhanced wide-waveband absorption across the visible to near-infrared spectral range. Due to the charge trapping and release at shallow trapping centers within the device channel, our optoelectronic graded neurons demonstrate remarkable photo-induced conductance plasticity at both 633 nm and 980 nm wavelengths. A dynamic vision system consisting of 20 × 20 optoelectronic neurons demonstrates remarkable capabilities in the precise detection and perception of various motions. Moreover, neural network computing systems have been built as visual motion perceptron to identify target object movement. The recognition accuracy of dual-wavelength fused images for various motion trajectories has experienced a remarkable enhancement, transcending the previous level of less than 80% to impressive values exceeding 99%. **Ziwei Li, Hunan University, China**
02	***Photonic Computing Circuit Enabled End-to-End Image Compression and Reconstruction*** **Abstract:** The rapid development of remote sensing, satellite radar, and medical equipment has created an imperative demand for ultra-efficient image compression and reconstruction that exceed the capabilities of electronic processors. For the first time, we demonstrate an end-to-end image compression and reconstruction approach using an opto-electronic computing processor, achieving adjustable compression ratio (from 2x to 256x) with orders-of-magnitude higher speed and lower energy consumption than electronic counterparts. **Ang Li, Nanjing University of Aeronautics and Astronautics, China**
03	***Genetic-Algorithm Topology-Optimized Hollow-Core Fiber*** **Abstract:** Conventional hollow-core fiber design typically relies on prior experience and a limited set of geometric primitives, making it difficult to explore highly random or non-intuitive structures. To address this, we propose a genetic-algorithm-based topology optimization framework: the material design domain is discretized and encoded as binary design variables, minimize confinement loss at 1550 nm. This approach requires no predefined geometric templates or parametric heuristics, enabling the automatic discovery of novel microstructures within the design space. Using this framework, we obtain a hollow-core fiber with a loss on the order of 10^-2 dB/m. The resulting structure exhibits hybrid guidance, arising from the combined suppression effects of photonic bandgap and anti-resonant mechanisms. **Zihan Liu, Hangzhou International Innovation Institute, Beihang University, China**

04	***Single-Channel-Readout Amplitude-Encoded Superconducting Single-Photon Detector Array*** **Abstract:** Photonic integrated circuits (PICs) are essential platforms in quantum science, particularly for quantum communication and quantum computing, which necessitate linear high-performance single-photon detector arrays. Superconducting nanowire single-photon detectors (SNSPDs) excel with excellent comprehensive performance and are compatibility with on-chip integration, making them the preferred choice for quantum photonic applications. However, conventional SNSPD arrays meet challenges related to readout complexity or speed reduction. Herein, we present an amplitude-encoded SNSPD array featuring single-channel readout and high-speed detection capabilities, successfully demonstrating high-quality discrimination of 12 pixels. This detector can readily achieve proof-of-concept quantum random number generation, underscoring its promise for advanced quantum information applications. **Rui Yin, Nanjing University, China**
05	***Fabrication and Characterization of Multi-Layer NAW Superconducting Nanowires*** **Abstract:** With the continuous development of infrared detection technology, infrared superconducting nanowire single-photon detectors (SNSPDs) are evolving toward higher pixel density, higher signal-to-noise ratio (SNR), and broader spectral response range. Traditional SNSPDs have improved performance and functionality by designing and optimizing the planar structure of the nanowires. However, the limitations of two-dimensional nanowire design are becoming increasingly evident and can no longer meet the growing demands of SNSPDs. The introduction of vertically parallel nanowires effectively breaks through the constraints imposed by planar nanowire structures. To address these challenges, this study advances the design of nanowire structures from two-dimensional to three-dimensional, proposing a vertically parallel SNSPD based on nitrogen-doped amorphous tungsten (NAW), along with its corresponding fabrication process. By fabricating multi-layer stacked films separated by dielectric layers and employing via etching techniques, the vertical parallelism of the nanowire structure is realized. Based on the proposed vertical parallel structure, an electrothermal coupling model is established, and the dynamic response mechanism of the vertically parallel SNSPD is theoretically analyzed. Furthermore, a three-layer vertically parallel SNSPD is fabricated using the proposed process. Experimental results show that by utilizing NAW thin films with a lower superconducting energy gap as the nanowire material and employing the three-layer vertical parallel design, the critical current density of the device reaches 10.2 μA, significantly outperforming both single- and double-layer structures. The photon counting rate curve exhibits three distinct saturation plateaus, and the detection mechanism of the vertically parallel SNSPD is validated through device testing. This study not only provides a new design approach for the structural optimization of SNSPDs, but also lays a theoretical foundation for the application of superconducting detectors in fields such as super-resolution imaging. **Fei Zhou, Nanjing University, China**
06	***Breakdown of Macroscopic Phase Coherence in Elongated Superconducting Nanowires*** **Abstract:** Clarifying the intrinsic length effect of superconducting nanowires (SNs) is crucial for advancing quantum circuits and detectors, as it underpins the development of high-precision quantum computing technologies. The cross-sectional dimensions of superconducting nanowires (SNs) are considered to govern the switch of phase transitions, whereas the length dimension is also crucial in determining their superconducting properties. Here, we demonstrate the regulation of superconductivity in SNs by length scale. We systematically investigated the transport properties of

	disordered SNs with lengths spanning three orders of magnitudes from 0.005 to 5.12 mm, while maintaining a constant small cross-sectional area. The SNs display an anomalous reduction in switching current with increasing length, which are inconsistent with previously proposed mechanisms based on structure inhomogeneity or discrete phase slips. Instead, they are in agreement with the model that originates from the breakdown of macroscopic phase coherence induced by phase fluctuation. **Huipeng Xia, Nanjing University, China**
07	***Polarization-Insensitive Superconducting Nanowire Single-Photon Detector With High Efficiency*** **Abstract:** Superconducting nanowire single-photon detectors (SNSPDs) face the critical challenge of simultaneously achieving high system detection efficiency (SDE) and low polarization dependence. This work proposes a joint design that optimizes both superconducting NbN films and a high-refractive-index antireflection coating (ARC) in the DBR-based cavity. This approach enables precise compensation of the electric field mismatch at the nanowire – dielectric interface, thereby enhancing the absorption of both TE- and TM-polarized light. Through rigorous coupled-wave analysis and finite element simulations, we systematically explore the joint parameter space of the ARC properties (refractive index and thickness) and the complex dielectric constant of NbN. This synergistic optimization identifies a robust operating window, with simulated absorption exceeding 99% for orthogonal polarizations and a near - unity polarization extinction ratio. The optimal structure results in over 90% absorption across the 1530 – 1640 nm band. Experimentally, the fabricated device achieves a maximum SDE of 97% at 1530 nm with a polarization sensitivity of 1.1 while maintaining a broadband PS < 1.3 from 1490 to 1640 nm. The detector also has a recovery time of 43.0 ns and a timing jitter of 63.5 ps. By unifying high efficiency with polarization insensitivity through material - and - structure codesign, this work provides a practical, high - performance SNSPD solution for quantum communications, free - space optical links, and single - photon imaging. **Xin Xu, Nanjing University, China**
08	***Sputtering Mode Diagram for the Precise Growth of NbN Superconductor Films*** **Abstract:** The sputtering mode diagram (SMD) provides a powerful tool for comprehensive structure engineering of functional films in developing advanced electronic devices, but has not reported due to the complexity of dynamic process and multi-parameters. Here, we report the SMD of superconductor niobium nitride (NbN) films with reactive magnetron sputtering. Poisoned mode, competing mode and metallic mode are drawn by the boundaries identified by the current–voltage curves of the sputtering system in the SMD, by which the phase structures and electronic properties of the NbN films can be precisely engineered. Typically, 9-nm-thick NbN films grown in the optimal poisoned and competing modes are applied for superconducting nanowire single-photon detectors (SNSPDs). The as-fabricated SNSPDs have flexible performances with saturated quantum efficiency and small kinetic inductance, which enables precise manipulation of the sensitivity and speed from the SMD. This work is also providing guidance for the research of other functional films and electronic devices, which can undoubtedly promote its practical application such as dark matter detection and high-speed quantum communication. **Mengfan Zhang, Nanjing University, China**

09	***Backside-etched SNSPDs with Enhanced System Detection Efficiency at 1064 nm*** **Abstract:** A system detection efficiency (SDE) of up to 90% is commonly reported for superconducting nanowire single-photon detectors (SNSPDs) coupled with single-mode fibers at 1550 nm. However, achieving an SDE of 50% for SNSPDs coupled with multimode fibers at 1064 nm, a wavelength widely used in lidar, remains a significant challenge. This difficulty primarily arises from two factors: first, the backside-illuminated structure, which is designed to focus incident light from multimode fibers onto the photosensitive area of the SNSPD, induces substantial absorption loss in the silicon substrate; second, the nanowire absorption efficiency exhibits pronounced polarization sensitivity. In this work, we report a backside-etched SNSPD design with improved SDE performance at 1064 nm. Specifically, a titanium dioxide layer is incorporated into the optical cavity to effectively suppress the polarization sensitivity. Concurrently, an additional dry etching step is implemented on the silicon substrate, reducing its intrinsic absorption loss from 25% to less than 5%. Experimentally, an SDE of 67% is achieved for our sample device at 1064 nm, with a minimum SDE exceeding 64% for all polarization states. This work demonstrates a high-performance solution optimized for 1064 nm, a wavelength offering superior atmospheric transmission and far-field beam characteristics, enabling broad applications in lidar, satellite laser ranging, and industrial manufacturing. **Chen Wei, Nanjing University, China**
10	***Development and Application of Optical Fiber Microprobe Laser Interferometer Displacement Measurement*** **Abstract:** With the proposal of Industry 4.0 and Made in China 2025, in the fields of new-generation high-end equipment integration, precision metrology and testing, and fundamental physics research, there is an urgent demand for micro-probe ultra-precision displacement measurement technology that is extremely small in size, easy to be embedded in experimental devices or precision equipment, and capable of performing tasks in confined Spaces. In response to the above demands, a super-precision fiber optic microprobe laser interference displacement measurement technology is studied. It is carried out from three perspectives: measurement principle, measurement reference, and measurement error correction, to solve the key problems of unmeasurable, inaccurate, and imprecise measurement. From the resolution of scientific problems, the breakthrough of key technologies to the realization of the prototype of the ultra-precision microprobe interferometer, the key theories and core technologies of high-resolution and large-range interferometry with microprobes, high-precision frequency stabilization under wide-range and high-bandwidth frequency modulation, and the elimination of nonlinear errors in signal demodulation periods have been respectively broken through, in order to support the sensor-based ultra-precision measurement requirements in equipment manufacturing. Provide embedded online measurement means for the research and development of high-end integrated equipment in our country and core instruments for nanometrics testing. **Yisi Dong, Harbin Institute of Technology, China**
11	***Atto-Molar Level Label-Free Detection of Nucleic Acids With Phase-Singularity Enhanced Beam Shift*** **Abstract:** Rapid and accurate detection of disease-related nucleic acids is essential for effective clinical diagnostics. Due to the superior selectivity, toehold-mediated strand displacement (TMSD) has emerged as a promising approach for nucleic acids detection. Currently, the mainstream TMSD assays are conducted in a buffer instead of a functionalized surface to minimize the barrier of strand displacement. However, these assays rely on fluorescent labels for tracking the reaction, which suffer

	from low quantum efficiency and photobleaching, requiring prolonged integration times for low-concentration targets and resulting in compromised detection limits. To address these challenges, we present a TMSD assay designed for plasmonic sensors, leveraging the inherent high sensitivity to achieve superior limits of detection without fluorescent markers. On sensor side, we exploit the enhanced Goos–Hänchen (GH) effect on extreme phase gradients at the plasmonic resonance. Since this phenomenon induces a dramatically amplified lateral beam shift signal in approaching the optical phase singularity. Additionally, the nature of strand displacement allows the utilization of preloaded contrast to further enhance the signal without labeling the target. The experiments suggests that our platform can detect oligo ss-DNA (30 bases) at an extremely low concentration of 1aM. Such detection limit is 2 to 4 orders of magnitude compared to conventional fluorescence-based methods. **Shaodi Zhu, The Chinese University of Hong Kong, China**
12	***Intracavity Second Harmonic Generation in an Extended-DBR Pockels Laser*** **Abstract:** Frequency-agile lasers at visible wavelengths are essential for applications in atomic sensors, optical clocks, and molecular spectroscopy. Here, we demonstrate a chip-integrated extended distributed Bragg reflector (E-DBR) Pockels laser based on a hybrid III–V/lithium niobate platform. The gain is provided by a III-V reflective semiconductor optical amplifier (RSOA), and electro-optic frequency tuning and second-harmonic generation are enabled by a lithium niobate nonlinear cavity. The fundamental-frequency emission in the telecom band has a narrow intrinsic linewidth of 194 Hz and mode-hop-free tuning range over 4.7 GHz with a tuning efficiency of 188 MHz V^{-1}. Furthermore, on-chip SHG delivers an output power of approximately 0.1 mW around 774 nm with a side-mode suppression ratio of 39 dB. Our approach provides a compact and power-efficient solution for frequency-agile visible lasers, enabling narrow linewidth and fast frequency tuning simultaneously on a fully integrated platform. **Xu Chen, National University of Singapore, Singapore**
13	***An Inter-Satellite Optical Link Analyzer (ISOLA) for Practical Optical Wireless Satellite Communication*** **Abstract:** This work presents a system-level Inter-Satellite Optical Link Analyzer (ISOLA), implemented as a MATLAB-based GUI for accurate modeling of high-speed optical wireless links. Beyond conventional link-budget tools, ISOLA incorporates optical-specific parameters—including wavelength, pointing loss, beam divergence, and optical efficiencies—and integrates experimentally measured data to refine key model inputs. In addition to analytical modeling, in-lab optical wireless communication (OWC) experiments using a GaN-based transmitter and an off-the-shelf optical receiver are conducted to provide practical calibration of the model. A separate case study based on NASA's TBIRD mission is used to benchmark ISOLA's predictive capability. For a transmitted power of 1 W, the analyzer estimates a received power of −13.4 dBm and a 23.7-dB link margin, closely matching TBIRD's demonstrated 200-Gb/s performance. The strong agreement validates the accuracy of the proposed framework and highlights its utility for evaluating and optimizing future high-speed inter-satellite optical links. **Shuo Sarah Feng, The Hong Kong University of Science and Technology, China**
14	***A 28-nm CMOS Thermally Adaptive Optical Transmitter for PCIe/CXL Interconnects*** **Abstract:** This work presents a temperature-robust, quarter-rate PAM-4 optical transmitter in 28-nm CMOS, enabling optical links compliant with the Peripheral Component Interconnect Express (PCIe) standard. To mitigate the severe thermal sensitivity of Vertical-Cavity Surface-Emitting Lasers

	(VCSELs), the transmitter incorporates a monolithic thermal control loop. This mechanism dynamically senses the thermal state and precisely adjusts the DC bias current, suppressing temperature-induced current variation by nearly an order of magnitude (from 6.42% to 0.73%). Simulation results demonstrate the design against 32-Gb/s (PCIe Gen5) and 64-Gb/s (PCIe Gen6) standards. Even at a severe operating temperature of 125℃, the active thermal loop successfully restores the closed optical eye, enabling functional PAM-4 operation. These findings validate monolithic thermal control as a scalable solution for next-generation high-performance computing (HPC) and data center interconnects. **Jia Fu, The Hong Kong University of Science and Technology, China**
15	***Free-Space Polarization Selecting and Energy Mosaicking of Ultralong Anti-diffracting Beam*** **Abstract:** A light beam propagating over an infinite anti-diffracting distance requires infinite power to preserve its shape. However, the fundamental barrier of finite power in free space has made the problem of diffraction insurmountable in recent decades. To overcome this limitation, we firstly report an approach that employs the multiple energy oscillation mechanism, thereby permitting the creation of a light beam with an ultralong anti-diffracting (UAD) distance in free space. Additionally, as far as we know, customizing multiple polarization modes within a single beam simultaneously and specifically remains a challenge, especially in an ultralong anti-diffracting distance along the optical path. This is because it imposes strict requirements on the correspondence between the incident light beams' polarization state and series of SoPs created, especially among the vector states of polarization (SoPs). Also, it needs the simultaneous presentation of variety modes along the propagation trajectory, or to transform, division, and recombination at on-demand positions in space, allowing complex polarization distributions to be flexibly customized. A versatile phase-polarization joint manipulation approach, including mode extraction principle and optical pen technique, is therefore developed to arbitrarily switch single or even multiple SoPs at on-demand positions in space [See Fig. 2]. It is noted that without superimposing at least two incident polarization modes, polarization modes in different transmission trajectories can be extracted directly from a single incident beam based on the principle on mode extraction. The number, position, amplitude and phase of polarization mode can further be arranged in an arbitrary manner with the aid of optical pen. A light beam with a tunable number of energy oscillations and even artifically designed SoPs is eventually generated in free space and propagates along a wavy trajectory. This work will enable the extension of non-diffractive light beams to an expanded realm and facilitate extensive developments in optics and other research fields, such as electronics and acoustics. **Yu Miao, The Chinese University of Hong Kong, China**
16	***Process-Control in-line with Spectral Fiber Systems*** **Abstract:** Chemical analysis plays a vital role in chemical process control, where fiber spectroscopy systems serve as essential tools together with mass spectroscopy, chromatography and other analytical methods. Today many spectrometers are produced for different methods of spectroscopy used in labs: absorption and reflection, Raman scattering and Fluorescence. The most of them allow analysis of "dead" samples – which must be collected from process and placed inside sample chamber of lab spectrometer. This sampling procedure excludes the possibility to monitor media changes during reaction in-line – in sharp difference with process-spectrometers which are coupled with different types of flexible fiber probes. Fiberoptic spectrometers and sensors help to replace common spectroscopy of "dead" samples by

	"live" spectroscopy – registering changes of media composition in real time. Robust fiber probes can be used for remote process-control in petrochemical, food and pharmaceutical industries – replacing time-consuming sampling. They can withstand broad temperature ranges from -150° C to +250° C, low and high pressure (up to 200 Bar or more), vibrations, aggressive liquids or gases, and electromagnetic fields, including microwave and hard radiation. Fiber probes assembled for 4 different fiber types can cover broad spectral range 0.3-16μm and used for all key spectroscopy methods: Transmission, Reflection, ATR-absorption, Raman & Fluorescence. Advanced fiber optic combi probes can also unite 2-3 spectroscopy methods in the same probe, while spectral data fusion from them provide enhanced sensitivity and accuracy in measurements of different media components. Multispectral Fiber Systems reveal the few key spectral features of selected process at the research phase - leading to the development of customized Spectral Fiber Sensors (SFS) required for automated process-control of the selected chemical reaction. These SFS should be produced at low cost in volume with AI-based chemometric model – providing media composition changes for sustainable production like IoT sensors. **Viacheslav Artyushenko, Art Fiber Systems GmbH, Germany**
17	***Dual-Domain SNR Enhancement and Fading Suppression Method for DAS*** **Abstract:** Distributed acoustic sensing (DAS) is an important branch of distributed optical fiber sensing , based on phase-sensitive optical time-domain reflectometry (Φ-OTDR). It is widely used in large-scale engineering facilities, such as pipeline security monitoring, seismic wave detection and surveillance systems. In DAS systems, measurement accuracy is affected by both coherent fading and random noises. This leads to the degeneracy of signal-to-noise ratio (SNR) during phase demodulation of the vibration signals, making it difficult to detect the minor vibration events effectively. Researchers proposed several methods to solve the fading issue. Spectrum extraction and remix (SERM) has demonstrated practical ability in eliminating fading phenomenon while it is constrained by the number of extractions in spectrums. The Three-Layer Structure Multiplexing (TLSM) method employs spatial multiplexing, trace decomposition, and multiple pulse detection to generate separate sub-components, which are then reassembled using the rotated vector summation (RVS) technique. However, these methods are limited to the processing of one-dimensional DAS digital dimension and mainly address the issue of fading suppression. DAS systems can measure multi-dimensional information in both time and space within the environment, while existing digital domain approaches fail to effectively leverage all the information present in the measured data in SNR enhancement and fading suppression. Methods solely applied in the digital signal processing domain can address the fading issues, but when it comes to the issue of enhancing the SNR of RBS phase signals, we can implement imaging processing strategies to the two-dimensional data attained from acoustic signal detection in DAS as well, which is treated as the temporal-spatial waterfall images of the phases. **Yihong Xiao, The Hong Kong Polytechnic University, China**
18	***Polarization-adjustment-free Optical Vector Analyzer*** **Abstract:** Interferometric optical vector analysis (OVA) based on orthogonal polarization interrogation and orthogonal polarization detection enables complete characterization of the spectral response of optical devices such as photonic integrated chips. However, in practical applications, such methods are often limited by the difficulty of precise polarization alignment and

	long-term polarization stability, which degrades measurement accuracy and robustness. To overcome this intrinsic limitation, we propose a polarization-adjustment-free Optical Vector Analysis (OVA) method, which enables comprehensive characterization of the transmission properties of the Device Under Test (DUT) without complex polarization control, while simultaneously achieving high measurement accuracy and high spectral resolution. On this basis, a corresponding optical vector analyzer instrument has been developed. In practical measurements, the instrument achieves a measurement dynamic range exceeding 65 dB, an insertion loss accuracy better than ±0.05 dB, a polarization-dependent loss accuracy better than ±0.02 dB, a group delay accuracy better than ±0.2 ps, and a polarization mode dispersion accuracy better than ±0.15 ps. Meanwhile, the system provides a maximum frequency resolution of up to 50 MHz, enabling precise characterization of high-Q microcavity devices and narrow-linewidth resonant structures in photonic integrated circuit testing scenarios. **Zhangjun Yu, Guangdong University of Technology, China**

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