



LIGHT CONFERENCE 2026

Northeast Asia International
Conference Center

JUNE 11-15, 2026

CHANGCHUN · CHINA

Hosts

International Day of Light Organizing Committee, UNESCO

European Optical Society

International Commission for Optics

IEEE Photonics Society

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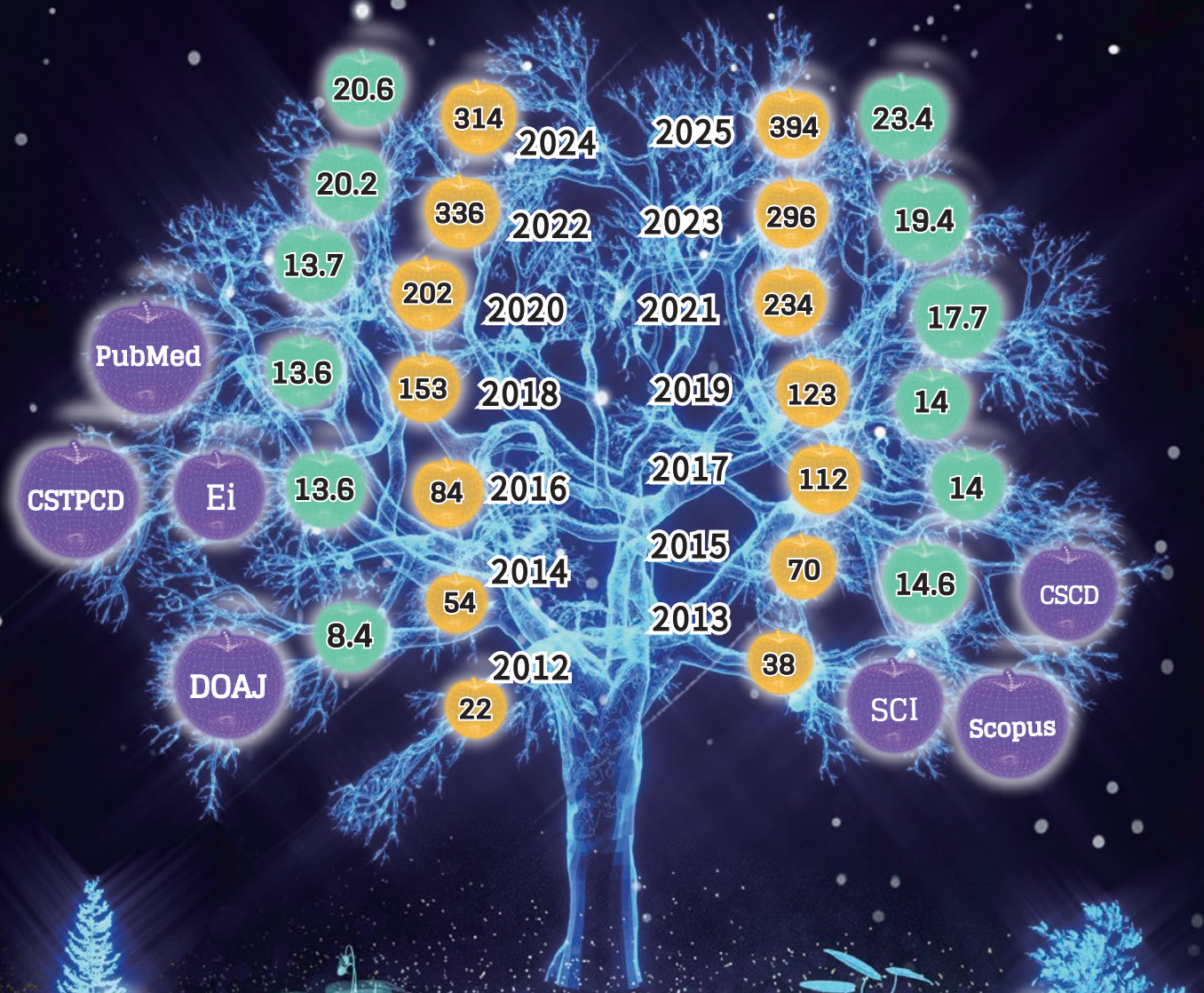
THE 15TH

Publication year

Indexed by

Impact Factor

Published article



10.6 2025

Light | Advanced Manufacturing
light-am.com



Light | Science & Applications
nature.com/lsa

32.1 2025

eLight
elight.springeropen.com

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Hosts



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General Information

Conference Venue: Northeast Asia International Conference Center, Changchun (长春东北亚国际会议中心)

Address: Xingbo Road, Chaoyang District, Changchun, Jilin, China (吉林省长春市朝阳区兴博路)

Speaker Preparation

For all speakers, please arrive at the session room 30 min before your talk for uploading and checking the PPT. The presentation language is English for Main Conference and Track 1-10, Chinese for Light Doctoral Academic League. No shows of the oral presentation will be recorded and these papers will not be published.

Poster Preparation

Authors are required to stand by their poster during the poster session for discussion. Please make sure to print your mobile tel. and email in the poster, because the conference staff will contact the winner of Best Poster Award, which will be selected on site.

Poster session: Friday, Jun. 12, 10:20-12:00

Poster board size: 0.95 m (length) * 2.47 m (height), recommended poster size:0.8m*1.2m

Location: 2F Changbai Hall Corridor (Conference Center)

Closing Ceremony and Award Ceremony

Location: 1F Huashan Hall, Conference Center (会议中心一楼华山厅)

The Closing Ceremony will be held on Sunday, Jun. 14, 15:30-18:00

The following awards will be present at the Closing Ceremony:

Best Paper Award

The candidates will be selected from all contributed submissions, according to the review outcomes. The selection will be voted by all session chairs and technical program chairs.

Best Poster Award

The winners will be selected by reviewers on site during the poster session.

WiFi: Light Password: LightConference

Light Moment

Precious photos on the conference can be found in Light moment, you can scan the right code to view and download them.

Light Moment Link:

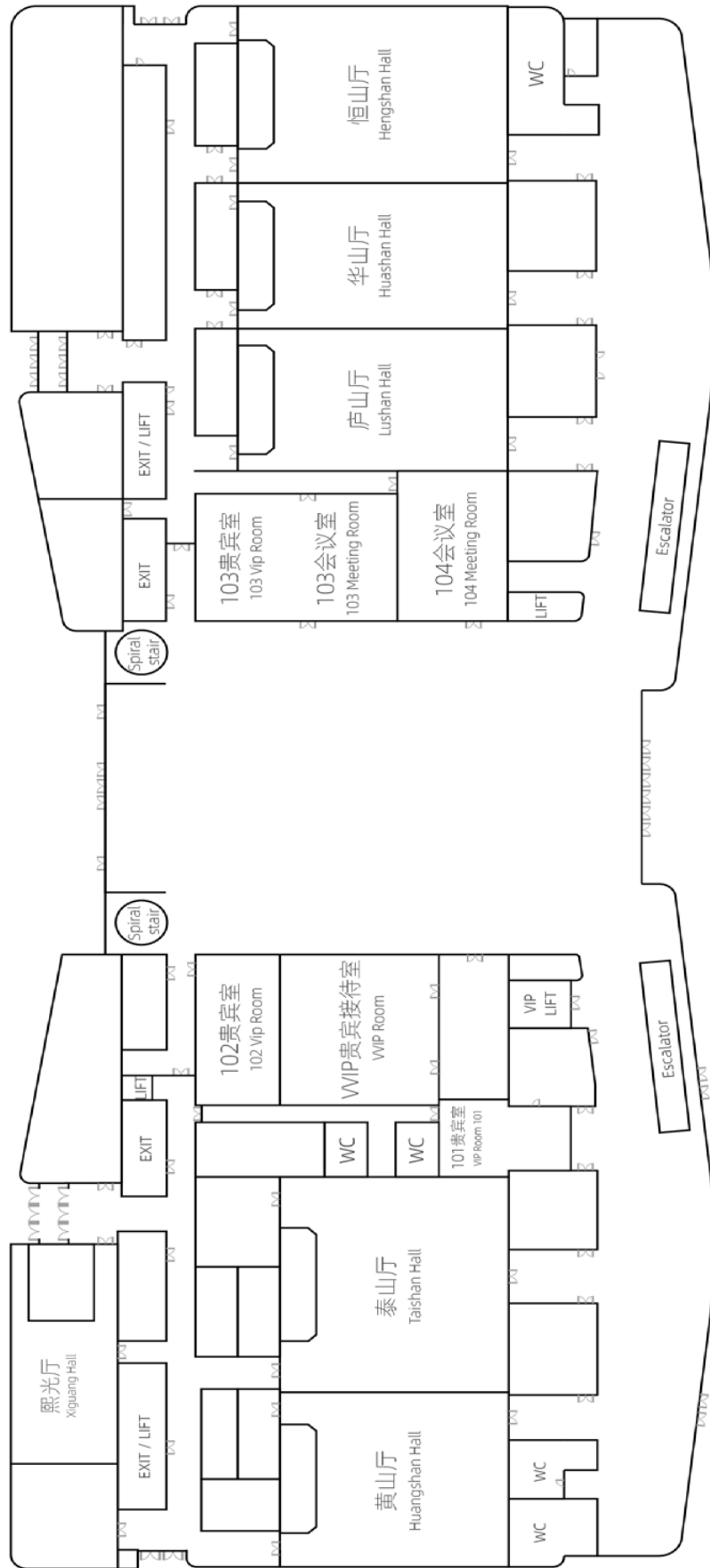
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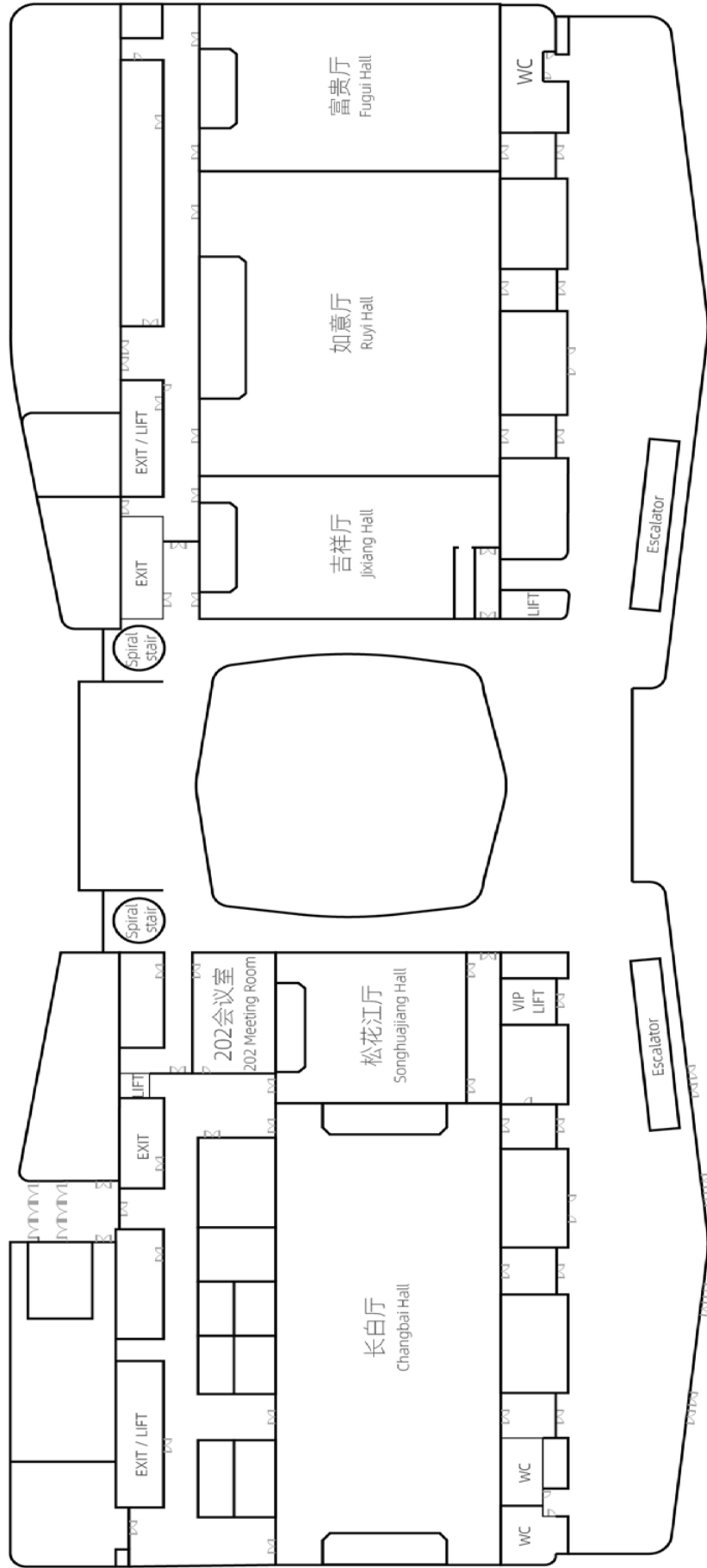
Tips

- ✓ You can go to registration desk if you need any help.
- ✓ Attendees can visit scenic spots such as Palace Museum of Manchukuo, Changying Old Site Museum, Changchun World Sculpture Park, Jingyuetan National Forest Park, Changchun Lotus Island Film & Leisure Cultural Park for free with your conference cards (go by yourself, no unified tour).

Map of 1F



Map of **2F**



General Program

	Thursday Jun. 11	Friday Jun. 12	Saturday Jun. 13	Sunday Jun. 14	Address	
Registration	09:00-20:00				Lobby, Wanda Vista Changchun International Movie Metropolis	
		09:00-18:00	09:00-18:00	09:00-18:00	1F, Northeast Asia International Conference Center	
LSA Editorial Board Meeting (in English) (By Invitation Only)	11:00-15:30				First Floor Lobby, New Quality Productive Forces Digital Innovation Center Phase II, CETDZ Optoelectronic Information Industrial Park	
Opening of the Changchun International Optoelectronic Exposition (in Chinese)		09:00-10:00			2F Ruyi Hall	
Poster Session		10:20-12:00			2F Changbai Hall Foyer	
Opening & Plenary Session (I) (in English)		13:30-18:00			2F Changbai Hall	
Opening Ceremony of the Changchun Flagship Conference of the Chinese Optical Society (in Chinese)			08:30-12:00		2F Changbai Hall	
Opening Ceremony of the Atomic-Level Manufacturing Conference (in Chinese)			09:30-12:00		2F Ruyi Hall	
Track 1: Green Agriculture (in English)			09:00-18:00		1F Xiguang Hall	
Track 2: Intelligent and Advanced Manufacturing (in English)			09:00-17:30		2F Songhuajiang Hall	
Track 3: Interdisciplinary Forum (in English)			09:00-18:00	09:00-15:30	1F Huangshan Hall	
Track 4: Micro- and Nano-Photonics (in English)			09:00-18:00	09:00-12:30	1F Room 102	Northeast Asia International Conference Center
Track 5: Intelligent light-field detection (in English)				09:00-15:30	1F Room 103	
Track 6: Optical Imaging and Display Technologies (in English)			09:00-18:00		1F Room 104	
Track 7: Biophotonics and Medical Optics (in English)				09:00-15:30	1F Room 104	
Track 8: Luminescence and Applications (in English)			09:00-18:00		1F Room 103	
Track 9: Light-responsive polymers and applications (in English)				09:00-15:30	1F Xiguang Hall	
Track 10: Light: Sino-Polish Photonics Forum (in English)				09:00-15:00	2F Songhuajiang Hall	
Light Doctoral Academic League Grand Final & Awards Ceremony (in Chinese)			09:00-18:00	09:00-15:20	1F Huashan Hall	
Plenary Session II & Closing Ceremony of Light Conference (in English)				15:30-17:10	1F Huashan Hall	

Conference Programs

Main Conference

Time	Content
June 12, Northeast Asia International Conference Center	
09:00-10:00	Opening of the Changchun International Optoelectronic Exposition (2F Ruyi Hall)
10:00-10:20	Break
10:20-12:00	Poster Session (2F Changbai Hall Corridor) Visit the Optoelectronics Exhibition (Exhibition Hall ABC)
12:00-13:30	Lunch
Opening Ceremony of Light Conference (2F Changbai Hall)	
Chair: Prof. Harald Giessen	
13:30-13:45	Welcome remarks (Prof. Paul Urbach; Prof. Xuejun Zhang)
13:45-13:55	Prof. Martin Booth, Co-Editor-in-Chief of <i>Light: Science & Applications</i> (University of Oxford, UK) Title: From Legacy to Horizon: Steering Light into a New Era of Global Impact
13:55-14:05	Light Annual Report Launching Ceremony (Prof. Hongbo Sun)
14:05-14:20	Awards Ceremony (Top Ten Social Impact Events in China's Optics (Light 10) /Light Outstanding Editors/Reviewers/Papers Awards)
14:20-14:25	Echoes of Light: A Tribute to Prof. Xi-Cheng Zhang
14:25-14:30	Group photo
Plenary Session I	
Chair: Prof. Hervé Maillotte	
14:30-15:05	Prof. Konstantin Novoselov (National University of Singapore, Singapore) (Plenary) Title: van der Waals heterostructures
15:05-15:35	Coffee Break
15:35-16:10	Prof. Xi-Cheng Zhang (University of Rochester, USA) (Plenary) Title: THz Photonics: A Journey from Scientific Curiosity to Transformative Technology
16:10-16:45	Prof. Martin Wegener (Karlsruhe Institute of Technology, Germany) (Plenary) Title: Holographic 3D laser printing at the speed-of-light limit
16:45-17:20	Prof. Cheng-Wei Qiu (National University of Singapore, Singapore) (Plenary) Title: Nonlinear 2D-Materials and vdW Metaphotonics
18:00-20:00	Banquet (Take shuttle bus from venue to hotel)

June 14, Northeast Asia International Conference Center, 1F Huashan Hall**Plenary Session II & Closing Ceremony of Light Conference****Chair: Prof. Martin Booth**

15:30-16:05	Prof. Yuguang Ma (South China University of Technology, China) (Plenary) Title: Organic Soliton Semiconductor
16:05-16:40	Prof. Lu Fang (Tsinghua University, China) (Plenary) Title: Computational Optics: A Symphony of Physics and Intelligence
16:40-17:00	<i>Awards Ceremony (Best Papers / Posters Awards)</i>
17:00-17:10	<i>Closing Speech</i>
18:00-20:30	<i>Dinner</i>

Track 1: Green Agriculture

Time	Content
June 13, Northeast Asia International Conference Center, 1F Xiguang Hall	
09:00-10:10	Session 1, Chair: Boris Mizaikoff
09:00-09:30	Prof. Cuong Cao (Queen's University Belfast, UK) (Keynote) Title: From Hotspot Formation to Reliable Signal Control: Engineering SERS and Nanozyme-Based Sensing in Agricultural Systems
09:30-09:50	Prof. Wenfa Lv (Jilin Agricultural University, China) (Invited) Title: Green Agriculture and Sustainable Beef Cattle Breeding
09:50-10:10	Prof. Wanneng Yang (Huazhong Agricultural University, China) (Invited) Title: What can high-throughput phenotyping and AI bring us?
10:10-10:40	Coffee break
10:40-12:10	Session 2, Chair: Jingqiu Liang
10:40-11:10	Prof. Bin Ren (Xiamen University, China) (Keynote) Title: AI-Enhanced Rapid SERS Screening of Trace Organic Compounds in Complex Matrices
11:10-11:30	Prof. Frits van Evert (Wageningen University, The Netherlands) (Invited) Title: The use of light-based technologies in automated farming
11:30-11:50	Prof. Mingdong Zhu (Hunan Academy of Agricultural Sciences, China) (Invited) Title: Laser Transmittance Spectroscopy Enables Nondestructive Single-Seed Vigor Sensing in Rice for Green Agriculture
11:50-12:10	Prof. Wenting Yang (Changchun Academy of Agricultural Sciences, China) (Invited) Title: Biocontrol Strains for Tobacco Disease Control
12:10-14:00	Lunch
14:00-15:10	Session 3, Chair: Frits van Evert
14:00-14:30	Prof. Boris Mizaikoff (University of Ulm, Germany) (Invited) Title: Mid-Infrared Technologies in Agri-Food Safety: Can Photonics Hunt a Cereal Killer?
14:30-14:50	Prof. Leo Marcelis (Wageningen University, The Netherlands) (Invited) Title: Lighting in high-tech farming systems
14:50-15:10	Prof. Yumin Zhao (Jilin Academy of Agricultural Sciences, China) (Invited) Title: Applications of Optical Technology in Modern Animal Husbandry
15:10-15:30	Coffee break
15:30-17:00	Session 4, Chair: Cuong Cao
15:30-15:50	Prof. Jingqiu Liang (Changchun Institute of Optics, Fine Mechanics and Physics, CAS, China) (Invited) Title: Technology and Instruments for Fluorescence Detection and Sorting of Third-Generation Hybrid Rice Propagation Line Seeds
15:50-16:10	Prof. Haitao Nie (Changchun Institute of Optics, Fine Mechanics and Physics, CAS, China) (Invited) Title: Research on Key Technologies and System Application of Intelligent Optoelectronics Empowering Livestock Target Performance Measurement

16:10-16:30	Prof. Xiaohui Yuan (Jilin Agricultural University, China) (Invited) Title: From Knowledge Density to Infrastructure: A Pathway to Constructing High-Quality Agricultural Datasets
16:30-16:50	Prof. Yucheng Zhang (ICT, CAS, China) (Invited) Title: Construction and Application Practice of Smart Agriculture Technology System at Fuxi Farm
16:50-17:00	Zhijie Xu (University College London, UK) (Oral) Title: Promoting Plant Growth by Horticulture Luminescent Solar Concentrators
18:00-20:00	<i>Dinner</i>

Track 2: Intelligent and Advanced Manufacturing

Time	Content
June 13, Northeast Asia International Conference Center, 2F Songhuajiang Hall	
09:00-10:20	Session 1, Chair: David H. Wei
09:00-09:30	Dr. Byoung Ho Lee (Park Systems Corporation, Korea) (Keynote) Title: Optic Technologies in Semiconductor Processes
09:30-10:00	Prof. Martin Booth (University of Oxford, UK) (Keynote) Title: Adaptive Optics and Precision Laser Fabrication
10:00-10:20	Prof. Ruidong Xue (University of Nottingham, UK) (Invited) Title: Physics-Informed Convolutional Neural Networks for Surface Reconstruction in Coherence Scanning Interferometry
10:20-10:50	<i>Coffee break</i>
10:50-11:40	Session 2, Chair: Byoung Ho Lee
10:50-11:20	Prof. Jun Ho Lee (Kongju National University, South Korea) (Keynote) Title: Adaptive Optics-Assisted Through-Focus Scanning Microscopy (TSOM) for Sub-Resolution Defect Inspection and Metrology
11:20-11:40	Prof. Zheng Xi (University of Science and Technology of China, China) (Invited) Title: Structured Light for Transverse Displacement Sensing
11:40-14:00	<i>Lunch</i>
14:00-15:10	Session 3, Chair: David H. Wei
14:00-14:30	Prof. Fumin Huang (Queen's University Belfast, UK) (Keynote) Title: Superoscillation: Beating the Diffraction Limit in the Far Field
14:30-14:50	Prof. Yijiang Shen (Guangdong University of Technology, China) (Invited) Title: Curvilinear OPC with AI-Powered SRAF Placement
14:50-15:10	Dr. Jing Fu (Shanghai Guicheng Technology, China) (Invited) Title: AI-Assisted Optical Proximity Correction for Faster Convergence in Semiconductor Manufacturing
15:10-15:40	<i>Coffee break</i>
15:40-16:50	Session 4, Chair: Byoung Ho Lee
15:40-16:00	Ms. Ying Wang (Guangdong University of Technology, China) (Invited) Title: A Unified Abbe-Hopkins Framework for Source-Mask Optimization in Advanced Lithography
16:00-16:20	Prof. Na Liu (Xiamen University, China) (Invited) Title: Efficient Thermal Prediction and Reduced-Order Modeling for Highly Integrated Systems
16:20-16:40	Prof. Xu Ma (Beijing Institute of Technology, China) (Invited) Title: Computational Lithography Empowered by AI
16:40-16:50	Mr. Wenxiang Hou (University of Science and Technology of China, China) (Oral) Title: Direct Laser Printing of 3D Hierarchical Ni(OH) ₂ /NiO Microarchitectures with Adjustable Porosity
18:00-20:00	<i>Dinner</i>

Track 3: Interdisciplinary Forum

Time	Content
June 13, Northeast Asia International Conference Center, 1F Huangshan Hall	
09:00-10:10	Session 1, Chair: Kyoung-Ho Kim
09:00-09:30	Prof. Laura Na Liu (University of Stuttgart, Germany) (Keynote) Title: Organic Electrochemical Meta-Displays
09:30-09:50	Prof. Costantino De Angelis (University of Brescia, Italy) (Invited) Title: Analog computing with nonlinear flat optics
09:50-10:10	Prof. Guang-Wei Hu (Nanyang Technological University, Singapore) (Invited) Title: Hyperbolic surface polaritonics on bulk crystals
10:10-10:50	Coffee break
10:50-12:10	Session 2, Chair: Laura Na Liu
10:50-11:10	Prof. Kyoung-Ho Kim (Kyung Hee University, Republic of Korea) (Invited) Title: Mie-assisted guided-mode excitation in synthetically fabricated silicon metawires
11:10-11:30	Prof. Peng Wang (Shanghai Institute of Technical Physics, CAS, China) (Invited) Title: Recent progress of the blocked impurity band VLWIR photodetector
11:30-11:50	Prof. Qi-Tong Li (Tsinghua University, China) (Invited) Title: Electrically tunable quantum localization and transport of interlayer excitons in an artificial superlattice
11:50-12:10	Prof. Xing-Yuan Lu (Soochow University, China) (Invited) Title: Tailoring Coherence for Dynamic Sensing
12:10-14:00	Lunch
13:30-15:10	Session 3, Chair: Alexander Shkurinov
13:30-14:00	Prof. Ai-Qun Liu (The Hong Kong Polytechnic University, China) (Keynote) Title: The Intersection of Quantum Microprocessors and AI Creates a Dynamic "Arms Race"
14:00-14:30	Prof. Xiao-Bo Yin (The University of Hong Kong, China) (Keynote) Title: Scalable Photonic Materials for Radiative Cooling and Sustainability
14:30-14:50	Prof. Sun Kyung Kim (Kyung Hee University, Republic of Korea) (Invited) Title: AI-Driven Inverse Design of Thermal Metamaterials
14:50-15:10	Prof. Ioannis Papakonstantinou (University College London, UK) (Invited) Title: Harvesting energy from the Cold Universe: The missing piece in the renewables puzzle
15:10-15:40	Coffee break
15:40-16:40	Session 4, Chair: Xiao-bo Yin
15:40-16:00	Prof. Alexander Shkurinov (Lomonosov Moscow State University, Russia) (Invited) Title: Terahertz Time-Resolved Nonlinear Optics of Hybrid Medium: From Gas to Liquid

16:00-16:20	Prof. Bo Hou (Cardiff University, UK) (Invited) Title: Inkjet-Printed Colloidal Quantum Dots as Solution-Processed Quantum Solids for Lighting and Sensing
16:20-16:40	Prof. Wei-Min Sun (Harbin Engineering University, China) (Invited) Title: Few mode to single mode fiber converter based on micro lens array and fiber bundle for astronomical spectral observation
18:00-20:00	<i>Dinner</i>
Time	Content
June 14, Northeast Asia International Conference Center, 1F Huangshan Hall	
09:00-10:10	Session 1, Chair: Harald Schneider
09:00-09:30	Prof. Fei Ding (Leibniz University Hannover, Germany) (Keynote) Title: Towards long distance quantum communication with deterministic single photon sources
09:30-09:50	Prof. Peng Zhang (Politecnico di Torino, Italy) (Invited) Title: Ambient Droplet Reactor: An Analytical Platform for Single-molecule Manipulations and Characterizations
09:50-10:10	Prof. Gui-Lu Long (Tsinghua University, China) (Invited) Title: Avoiding Decapitation Strikes: Quantum Direct Communication with Exposure Awareness
10:10-10:50	<i>Coffee break</i>
10:50-11:50	Session 2, Chair: Fei Ding
10:50-11:10	Prof. Harald Schneider (Helmholtz Zentrum Dresden Rossendorf, Germany) (Invited) Title: THz near-field imaging with a free-electron laser
11:10-11:30	Prof. Ya-Ting Wan (King Abdullah University of Science and Technology, Saudi Arabia) (Invited) Title: Integrated Silicon Photonics with Quantum Dot On-Chip Lasers
11:30-11:50	Prof. Krzysztof Tyszka (University of Warsaw, Poland) (Invited) Title: Towards VCSEL array-based optical neural sensors
11:50-14:00	<i>Lunch</i>
14:00-15:20	Session 3, Chair: Yating Wan
14:00-14:20	Prof. Daa Khalil (Ain Shams University, Egypt) (Invited) Title: From Sensor Solutions to Physical AI: How the Micro_Photonic can support the new era of the AI
14:20-14:40	Prof. Meng-Jian Zhu (National University of Defense Technology, China) (Invited) Title: Toward p-type 2D semiconductors: from efficient hole doping to wafer-scale growth
14:40-15:00	Prof. Jun-Jia Wang (Southeast University, China) (Invited) Title: Heterogeneous integrated optical modulators and photodetectors for communication and computing
18:00-20:00	<i>Dinner</i>

Track 4: Micro-and Nano-Photonics

Time	Content
June 13, Northeast Asia International Conference Center, 1F Room 102	
09:00-10:05	Session 1, Chair: Harald Giessen
09:00-09:25	Prof. Lei Zhou (Fudan University, China) (Keynote) Title: Metasurfaces for manipulating vectorial light fields
09:25-09:45	Prof. Oleksii Ilchenko (Lightnovo ApS, Denmark) (Invited) Title: qRICO-Net: machine-learning-based crystallographic orientation mapping using polarized Raman microscopy
09:45-10:05	Prof. Renmin Ma (Peking University, China) (Invited) Title: Narwhal wavefunctions and the quest for ultimate light localization
10:05-10:30	<i>Coffee break</i>
10:30-11:55	Session 2, Chair: Wolfgang Freude
10:30-10:55	Prof. Jin Zhong Zhang (University of California Santa Cruz, USA) (Keynote) Title: Shed Light on chirality and carrier spin dynamics of metal halide perovskite quantum dots and nanoclusters
10:55-11:15	Prof. Jianhua Jiang (University of Science and Technology of China, China) (Invited) Title: TBD
11:15-11:35	Prof. Kosmas L. Tsakmakidis (National and Kapodistrian University of Athens, Greece) (Invited) Title: Theory and applications of complex-frequency excitations in photonics
11:35-11:55	Prof. Ifor Samuel (University of St Andrews, UK) (Invited) Title: OLEDs with Record Light Output for Communications and an Electrically Driven Polymer Laser
11:55-14:00	<i>Lunch</i>
14:00-15:05	Session 3, Chair: Jin Zhong Zhang
14:00-14:25	Prof. Sergey Gaponenko (B. I. Stepanov Institute of Physics, National Academy of Sciences of Belarus) (Keynote) Title: Colloidal nanoplasmonics to enhance light-matter interaction in nanophotonic devices
14:25-14:45	Prof. Wolfgang Freude (Karlsruhe Institute of Technology, Germany) (Invited) Title: Wireless THz single-polarization high-speed P2P and P2MP transmission over long and short distances
14:45-15:05	Prof. Long Zhang (Xiamen University, China) (Invited) Title: Valley-Engineered Landau Polaritons in a Van der Waals Semiconductor Microcavity
15:05-15:40	<i>Coffee break</i>
15:40-17:40	Session 4, Chair: Oleksii Ilchenko
15:40-16:00	Prof. Harald Giessen (University of Stuttgart, Germany) (Invited) Title: Discovery of phonon-polaritonic skyrmions

16:00-16:20	Prof. Jingtian Hu (Harbin Institute of Technology (Shenzhen), China) (Invited) Title: Training of Free-space Optical Visual Processors
16:20-16:40	Prof. Xinfeng Liu (National Center for Nanoscience and Technology) (Invited) Title: Carrier Dynamics in Superlattice Material System
16:40-17:00	Prof. Feng Li (Xi'an Jiaotong University, China) (Invited) Title: Optical skyrmions in single microcavities formed by photonic spin-orbit coupling
17:00-17:20	Prof. Yu Luo (Nanjing University of Aeronautics and Astronautics, China) (Invited) Title: Shining wrinkles: making graphene emissive at room-temperature
17:20-17:40	Prof. Feng Liu (Zhejiang University, China) (Invited) Title: Single-photon sources based on quantum dots in photonic crystal cavities
18:00-20:00	Dinner
Time	Content
June 14, Northeast Asia International Conference Center, 1F Room 102	
09:00-10:10	Session 1, Chair: Ifor Samuel
09:00-09:20	Prof. Paulo Dainese (Corning Research & Development Corporation, USA) (Invited) Title: Wavefront Control with Metasurfaces for Optical Interconnects
09:20-09:40	Prof. Siying Peng (Westlake University, China) (Invited) Title: Continuous-Wave Chiral Exciton-Polariton Lasers Across the Visible and Infrared
09:40-10:00	Prof. Weitao Liu (Fudan University, China) (Invited) Title: Field-enhanced nonlinear optics of low-dimensional and interfacial systems
10:00-10:10	Dr. Yue Liu (University of Science and Technology of China, China) (Oral) Title: Research on Shear Phonon Polaritons in CdWO ₄
10:10-10:40	Coffee break
10:40-12:20	Session 2, Chair: Kosmas L. Tsakmakidis
10:40-11:00	Prof. Qing Zhang (Peking University, China) (Invited) Title: Harnessing highly efficient coherent polariton parametric emission in quantum confined microcavities
11:00-11:20	Prof. Jingwen Ma (The University of Hong Kong, China) (Invited) Title: Light-matter interactions in photonic nanostructures and magnetic nanomaterials
11:20-11:40	Prof. Jun Guan (The Chinese University of Hong Kong (Shenzhen), China) (Invited) Title: Structured Lasing with Topological and Moiré Photonic Cavities
11:40-12:00	Prof. Cheng Zhang (Huazhong University of Science and Technology, China) (Invited) Title: Optical Metasurface Empowered Imaging and Displaying
12:00-14:00	Lunch

Track 5: Intelligent Light-Field Detection

Time	Content
June 14, Northeast Asia International Conference Center, 1F Room 103	
09:00-10:10	Session 1, Chair: Tawfique Hasan
09:00-09:30	Prof. Yang Chai (The Hong Kong Polytechnic University, China) (Keynote) Title: Bioinspired In-Sensor Computing for Artificial Vision
09:30-09:50	Prof. Xuhan Guo (Shanghai Jiao Tong University, China) (Invited) Title: Integrated Photonics for Intelligent light Computing
09:50-10:10	Prof. Ni Chen (The University of Hong Kong, China) (Invited) Title: Differentiable Imaging
10:10-10:40	<i>Coffee break</i>
10:40-11:50	Session 2, Chair: Yang Chai
10:40-11:10	Prof. Weida Hu (Shanghai Institute of Technical Physics, CAS, China) (Keynote) Title: Infrared Photodetectors: From High-Performance to Intelligence
11:10-11:30	Prof. Haiding Sun (University of Science and Technology of China, China) (Invited) Title: Integrated Ultraviolet Optoelectronics for High-Speed Solar-Blind Optical Communication and Miniaturized Spectral Imaging
11:30-11:50	Prof. Qixiang Cheng (University of Cambridge, UK) (Invited) Title: Chip-scale Spectroscopic Metrology: From Programmable Photonics to Biomedical Sensing
11:50-13:30	<i>Lunch</i>
13:30-14:30	Session 3, Chair: Qixiang Cheng
13:30-13:50	Prof. Zongyin Yang (Zhejiang University, China) (Invited) Title: Toward Next-Generation Spectral Detection: A Miniaturized High-Performance Solution
13:50-14:10	Prof. Wei Zhang (Tsinghua University, China) (Invited) Title: Reconstructive photon-counting spectrometer and its application on high-dimensional imaging
14:10-14:30	Prof. Hanxiao Cui (Sichuan University, China) (Invited) Title: Unified Information-theoretic Framework for Adaptive Spectral Encoders
14:30-15:30	Session 4, Industry Discussion, Chair: Tawfique Hasan, Weiwei Cai, Zongyin Yang
	Prof. Xin Yuan (Westlake University, China) (Invited) Dr. Haiwei Yin (Shanghai IdeaOptics Co., Ltd., China) (Invited)
18:00-20:00	<i>Dinner</i>

Track 6: Optical Imaging and Display Technologies

Time	Content
June 13, Northeast Asia International Conference Center, 1F Room 104	
09:00-10:30	Session 1, Chair: Feihu Xu
09:00-09:30	Prof. Giancarlo Ruocco (Italian Institute of Technology, Italy) (Keynote) Title: Probing Frequency-Dependent Elastic Properties in Condensed Matter via Brillouin Light Scattering
09:30-09:50	Prof. Se Young Chun (Seoul National University, Korea) (Invited) Title: Restoring the Unseen: Learning-based Inverse Problems from Multi-degradation Imaging to Lensless Cameras
09:50-10:10	Prof. Xing Fu (Tsinghua University, China) (Invited) Title: Non-line-of-sight imaging on arbitrary relay surfaces
10:10-10:30	Prof. Evan Y. Peng (The University of Hong Kong, China) (Invited) Title: "Extended" Imaging & Display: Mixing Optics, Graphics, and AI
10:30-10:50	<i>Coffee break</i>
10:50-12:00	Session 2, Chair: Liangcai Cao
10:50-11:20	Prof. Hongwei Chen (Tsinghua University, China) (Keynote) Title: Post-Imaging Era: Optical Pre-sensor Computing
11:20-11:40	Prof. Ryoichi Horisaki (The University of Tokyo, Japan) (Invited) Title: Computational imaging with randomness
11:40-12:00	Prof. Baoqing Sun (Shandong University, China) (Invited) Title: Single-pixel near infrared hyperspectral imaging with optoelectronic spectrum modulation
12:00-14:00	<i>Lunch</i>
14:00-15:30	Session 3, Chair: Hongwei Chen
14:00-14:30	Prof. Liangcai Cao (Tsinghua University, China) (Keynote) Title: A deep artifact removal approach for multi-core fiber imaging
14:30-14:50	Prof. Zhipeng Huang (TU Dortmund University, Germany) (Invited) Title: Capture molecular movies with ultrafast photons and electrons: from isolated gas-phase to liquid- and solid-phase samples
14:50-15:10	Prof. Ze Zhang (Aerospace Information University, China) (Invited) Title: Optical Pin Beam and Its Generalized Applications
15:10-15:30	Prof. Fei Liu (Xidian University, China) (Invited) Title: Research on Multidimensional Information Decoupling in Scattered Optical Fields
15:30-15:50	<i>Coffee break</i>
15:50-17:05	Session 4, Chair: Xin Yuan
15:50-16:10	Prof. Shihai Sun (Sun Yat-sen University, China) (Invited) Title: Single-pixel Temporal single photon LiDAR

16:10-16:30	Prof. Weiwei Cai (Shanghai Jiao Tong University, China) (Invited) Title: Background-Oriented Schlieren Tomography for Flow Diagnostics
16:30-16:50	Prof. Fei Qiao (Tsinghua University, China) (Invited) Title: From "Sensing-with-Computing" to Photonics-Electronics-Mixing ICs for Emerging Computing Power Requirements
16:50-17:05	Dr. Yunhui Gao (Tsinghua University, China) (Oral) Title: Characterizing complex wavefields with a high-resolution computational wavefront sensor
18:00-20:00	<i>Dinner</i>

Track 7: Biophotonics and Medical Optics

Time	Content
June 14, Northeast Asia International Conference Center, 1F Room 104	
09:00-10:30	Session 1, Chair: Yuxuan Ren
09:00-09:30	Prof. Lothar Lilge (University of Toronto, Canada) (Keynote) Title: Can personalized PDT treatment planning provide clinically significant improvements?
09:30-09:50	Prof. Juergen Czarske (TU Dresden, Germany) (Invited) Title: Computational imaging without computer and quantum imaging without detected light
09:50-10:10	Prof. Peng Xi (Peking University, China) (Invited) Title: Super-resolution structured illumination microscopy: polarization, anisotropy, and lattice
10:10-10:30	Prof. Jiawei Sun (Suzhou Institute of Biomedical Engineering and Technology, CAS, China) (Invited) Title: Advancing Quantitative Phase Imaging with Lensless Fiber Endomicroscopy
10:30-10:45	Coffee break
10:45-12:05	Session 2, Chair: Juergen Czarske
10:45-11:05	Prof. Fernando D. Stefani (National Scientific and Technical Research Council, Argentina) (Invited) Title: Nanometer Precision Single Molecule Localization with Raster Scanning Fluorescence Microscopes: Benchmarking RASTMIN, RASTMAX, and RASTED
11:05-11:25	Prof. Wuwei Ren (ShanghaiTech University, China) (Invited) Title: Free-space SPAD array-based diffuse optical tomography facilitates in vivo functional imaging
11:25-11:45	Dr. Jianglai Wu (Chinese Institute for Brain Research, China) (Invited) Title: Miniature Bessel-beam two-photon microscopy enables high-throughput brain imaging in freely moving mice
11:45-12:05	Dr. Hongsen He (Xiamen University, China) (Invited) Title: Reconfiguring Laser Sources for Microscopy: Embedding Imaging Functions into the Source
12:05-13:15	Lunch
13:15-14:15	Session 3, Chair: Peng Xi
13:15-13:35	Dr. Liam Collard (King's College London, UK) (Invited) Title: Rapid Tomographic Multiphoton Fluorescence Lifetime Imaging
13:35-13:55	Prof. Xinglin Zeng (Shanghai Institute of Optics and Fine Mechanics, CAS, China) (Invited) Title: Chiral photon-phonon Brillouin interaction: in twisted photonic crystal fiber and biophotonic applications
13:55-14:15	Dr. Li Zhang (Istituto Italiano di Tecnologia, Italy) (Invited) Title: Brillouin Microscopy as a Tool for Probing Mechanics from Tissues to Biomolecular Condensates
14:15-14:30	Coffee break

14:30-16:00	Session 4, Chair: Fernando D. Stefani
14:30-15:00	Prof. Andrey Dunaev (Orel State University, Russia) (Keynote) Title: Multimodal wearable optical analyzers of microcirculatory-tissue systems of the human body
15:00-15:20	Prof. Xingde Li (Johns Hopkins University, USA) (Invited) Title: From Surgery to Behavior: Low-Coherence Biophotonics for Brain Imaging
15:20-15:40	Prof. An Pan (Xi'an Institute of Optics and Precision Mechanics, CAS, China) (Invited) Title: High-throughput stitching-free whole slide imaging system via Fourier ptychographic microscopy and its applications in hemopathy
15:40-16:00	Dr. Jiazhang Wang (University of Arizona, USA) (Invited) Title: Computational 3D Metrology for Biomedical Surface Imaging
18:00-20:00	Dinner

Track 8: Luminescence and Applications

Time	Content
June 13, Northeast Asia International Conference Center, 1F Room 103	
09:00-10:10	Session 1, Chair: Xiao-Jun Wang
09:00-09:30	Prof. Xiaogang Liu (National University of Singapore, Singapore) (Keynote) Title: Designing light at the atomic scale: the chemistry of lanthanide nanomaterials
09:30-09:50	Prof. Bin Dong (Dalian Minzu University, China) (Invited) Title: Rare Earth ions 4f Electron Upconversion: Manipulation and Applications
09:50-10:10	Prof. Xue Bai (Jilin University, China) (Invited) Title: Lanthanide-based materials and optoelectronic devices
10:10-10:40	Coffee break
10:40-12:00	Session 2, Chair: Xue Bai
10:40-11:00	Prof. Caofeng Pan (Beihang University, China) (Invited) Title: Metal halide perovskite arrays and artificial vision imaging devices
11:00-11:20	Prof. Zhongqiang Wang (Northeast Normal University, China) (Invited) Title: Oxide-based optoelectronic memristive materials and bionic vision devices
11:20-11:40	Prof. Guogang Li (China University of Geosciences (Wuhan), China) (Invited) Title: Structure design and luminescence tuning for stimulus-responsive luminescent materials
11:40-12:00	Prof. Yixi Zhuang (Xiamen University, China) (Invited) Title: Tailoring trap depths in luminescent materials for emerging applications
12:00-13:40	Lunch
13:40-15:20	Session 3, Chair: Caofeng Pan/Zhongqiang Wang
13:40-14:00	Prof. Liang Shen (Jilin University, China) (Invited) Title: Study on novel semiconductor photodetection materials and devices and their application
14:00-14:20	Prof. Jianxin Tang (Soochow University/Macau University of Science and Technology, China) (Invited) Title: Rational Charge-Transfer Modulation for Narrowband Blue Thermally Activated Delayed Fluorophores
14:20-14:40	Prof. Kaikai Liu (Zhengzhou University, China) (Invited) Title: Semiconductor quantum dot luminescence and X-ray detection
14:40-15:00	Prof. Dengfeng Peng (Shenzhen University, China) (Invited) Title: Self-recovery mechanoluminescence of magnesium and aluminum based smart oxides
15:00-15:20	Prof. Tao Yu (Northwestern Polytechnical University, China) (Invited) Title: Molecular engineering for organic mechanoluminescence
15:20-15:50	Coffee break

15:50-17:50	Session 4, Chair: Jianxin Tang/Renren Deng
15:50-16:10	Prof. Renren Deng (Zhejiang University, China) (Invited) Title: Dye-coupled lanthanide nanocrystals for advanced optical biosensing and photodynamic therapy
16:10-16:30	Prof. Huifang Shi (Nanjing Tech University, China) (Invited) Title: Ultralong organic phosphorescence
16:30-16:50	Prof. Dezhi Tan (Zhejiang University, China) (Invited) Title: Photonic glass and applications
16:50-17:10	Prof. Jiaqi Zhang (Jilin University, China) (Invited) Title: Manipulating ionic defects in quantum dot optoelectronic devices
17:10-17:30	Prof. Lihua Lin (Fuzhou University, China) (Invited) Title: Electric-field topology and confined exciton dynamics in ultrahigh-resolution QLEDs
17:30-17:50	Prof. Lei Zhou (Sun Yat-sen University, China) (Invited) Title: High-efficiency rare earth luminescent materials for marine applications: design, preparation, and exploration
18:00-20:00	Dinner

Track 9: Light-responsive Polymers and Applications

Time	Content
June 14, Northeast Asia International Conference Center, 1F Xiguang Hall	
09:00-10:30	Session 1, Chair: Danqing Liu
09:00-09:05	Opening Remarks-Emiliano Descrovi (Politecnico di Torino, Italy)
09:05-09:40	Prof. Dirk Jan Broer (Eindhoven University of Technology, The Netherlands) (Keynote) Title: Liquid Crystal Networks: A Unique Materials Platform for Optics, Haptics and Soft Robotics
09:40-10:05	Prof. Fabian Eisenreich (Eindhoven University of Technology, The Netherlands) (Invited) Title: From light beams to materials dreams: Tuning polymer functions with photons
10:05-10:30	Prof. Yuxin You (South China Normal University, China) (Invited) Title: Programmed light-responsive topographical deformations in liquid crystal polymers
10:30-10:50	<i>Coffee break</i>
10:50-12:15	Session 2, Chair: Dirk Jan Broer
10:50-11:25	Prof. Deng-ke Yang (South China University of Technology, China) (Keynote) Title: Liquid Crystal for Smart Windows
11:25-11:50	Prof. Sara Nocentini (INRIM, National Metrology Institute of Italy, Italy) (Invited) Title: 3D reconfigurable photonic systems by liquid crystalline polymers
11:50-12:15	Prof. María Gabriela Capeluto (University of Buenos Aires, Argentina) (Invited) Title: Photoinduced properties of PAZO-based systems with molecular and nanoparticle additives: experimental and simulation studies
12:15-13:30	<i>Lunch</i>
13:30-15:20	Session 3, Chair: Emiliano Descrovi
13:30-13:55	Prof. Jan Lagerwall (University of Luxembourg, Luxembourg) (Invited) Title: Hidden in plain sight: Information for robots and Augmented Reality invisibly encoded using bioinspired structural color reflectors
13:55-14:20	Prof. Yanjun Liu (Southern University of Science and Technology, China) (Invited) Title: Light-driven liquid crystalline materials for chiroptics and actuation
14:20-14:45	Prof. Danqing Liu (Eindhoven University of Technology, The Netherlands) (Invited) Title: Light trained intelligent liquid crystal polymers
14:45-15:10	Dr. Linjie Dai (Peking University, China) (Invited) Title: Spin engineering in low-dimensional emitters
15:10-15:20	Dan Chen (National University of Defense Technology, China) (Oral) Title: All-solid passive organic optical limiter via coordination-bond anchoring strategy
18:00-20:00	<i>Dinner</i>

Track 10: Light: Sino-Polish Photonics Forum

Time	Content
June 14, Northeast Asia International Conference Center, 2F Songhuajiang Hall	
09:00-10:25	Session 1, Chair: Chao Zuo
09:00-09:25	Prof. Karol Karnowski (Centre for Translational Eye Research, Poland) (Keynote) Title: ICTER: Redefining Ophthalmology through Multidisciplinary Excellence and Global Collaboration
09:25-09:45	Prof. Malgorzata Kujawska (Warsaw University of Technology, Poland) (Invited) Title: Towards digital twins of quantitative phase imaging systems in biomedical applications
09:45-10:05	Prof. Renjie Zhou (The Chinese University of Hong Kong, China) (Invited) Title: Coherence-gated optical diffraction tomography for label-free volumetric imaging of cells in thick tissues
10:05-10:25	Prof. Peng Gao (Xidian University, China) (Invited) Title: Quantitative Phase Microscopy and Phase Correlation Spectroscopy for Biology
10:25-10:35	<i>Coffee break</i>
10:35-12:20	Session 2, Chair: Maciej Trusiak
10:35-11:00	Prof. Lukasz A. Sterczewski (Wroclaw University of Science and Technology, Poland) (Keynote) Title: Ultra-broadband spectroscopy from the UV to the THz using coherent and incoherent light sources
11:00-11:20	Prof. Michał Parniak (University of Warsaw, Poland) (Invited) Title: All-optical microwave and THz sensors based on Rydberg atoms
11:20-11:40	Prof. Shaohui Zhang (Beijing Institute of Technology, China) (Invited) Title: Obj\$plat: Geometry-aware Gaussian surfels for active object reconstructions
11:40-12:00	Prof. Jingdan Liu (Shanghai Institute of Optics and Fine Mechanics, CAS, China) (Invited) Title: Recent advances in single-shot computational ultrafast imaging
12:00-12:20	Prof. Shijie Feng (Nanjing University of Science and Technology, China) (Invited) Title: Spatiotemporal super-resolution of structured-light 3D imaging driven by physical priors and artificial intelligence
12:20-13:30	<i>Lunch</i>
13:30-15:00	Session 3, Chair: Malgorzata Kujawska
13:30-13:50	Prof. Maciej Trusiak (Warsaw University of Technology, Poland) (Invited) Title: From chemical contrast to scattering-robust tomography: broadband lensless computational microscopy for label-free high-content bioimaging
13:50-14:10	Prof. Chao Zuo (Nanjing University of Science and Technology, China) (Invited) Title: Computational phase imaging for label-free 3D microscopy: noninterferometric phase retrieval and intensity diffraction
14:10-14:30	Prof. Piotr Zdańkowski (Warsaw University of Technology, Poland) (Invited) Title: Common-Path Diffraction Tomography: Overcoming the Conjugate Image Problem in Dense Samples
14:30-14:45	Prof. Shengjia Wang (Harbin Engineering University, China) (Oral) Title: Phase Manipulating Fresnel Lenses for Differential Interference Quantitative Phase Microscopy

14:45-15:00	Dr. Zhuoshi Li (Nanjing University of Science and Technology, China) (Oral) Title: Learning to self-interfere: zero-shot deconvolution enables replica-free, low-coherence common-path quantitative phase microscopy
18:00-20:00	<i>Dinner</i>

Plenary Session

Van der Waals heterostructures

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Graphene and 2D materials, despite being relatively fresh materials, have already taken a firm place in research, development and applications. A number of exciting phenomena have been discovered in these crystals and they continue bringing exciting results on a regular basis. However, probably the most important characteristic about 2D materials is that they offer a possibility to form on-demand van der Waals heterostructures, where individual 2D crystals are stacked together, forming a novel, 3D structure, whose composition (and thus, their properties) can be controlled with atomic precision. This has opened new directions of research: materials on demand. The properties of the resulting heterostructure can be designed with very high precision. The space of parameters is so large that the use of machine learning methods becomes essential. Furthermore, since individual components in such heterostructures interact through a number of channels (elastic, van der Waals, electronic, etc.) – a degenerate energy landscape is formed, leading to a number of competing phases, which opens a way to engineer particular phase transitions between different states and, thus, study also the out-of-equilibrium phenomena in such structures.



Short Bio: Prof. Dr. Konstantin S. Novoselov holds dual British and Russian citizenship and is affiliated with the National University of Singapore. He has received numerous prestigious scientific awards and honorary titles, including the Nobel Prize in Physics, Fellowship of the Royal Society (FRS), Foreign Associate of the National Academy of Sciences (USA), Honorary Fellow of the Royal Society of Chemistry (HonFRSC), and Honorary Fellow of the Institute of Physics (HonFInstP). He was elected as a Foreign Member of the Chinese Academy of Sciences in 2023.

He was the first to isolate graphene and other single-atom-thick materials and unravel their extraordinary properties, pioneering the entire field of two-dimensional (2D) materials research. He founded the new research direction of atomically precise construction of 2D van der Waals heterostructures, which enables multi-dimensional tailoring of the physical and chemical properties of 2D material systems, driving their transformative applications in optoelectronic physics, catalytic science, and functional smart materials.

THz Photonics: A Journey from Scientific Curiosity to Transformative Technology

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X.-C. Zhang

THz photonics, an extension of microwave photonics that emerged in the mid-1980s, represents a journey from scientific curiosity to transformative technology. The development of ultrashort-pulsed lasers, optical rectification, Auston switches, novel electro-optic materials, and industrial opportunities established THz photonics as a distinct field within the THz community.

Three major scientific milestones define this evolution: [1] Ultrafast THz Emitters/Detectors Using Femtosecond Lasers: The foundation of pulsed THz systems was laid by breakthroughs such as optical rectification (Shen, 1971), photoconductive antennas (Auston, 1975), and photoconductive switches for microwave-to-THz applications (Mourou and Lee, 1981–1984). [2] Time-Domain Spectroscopy (TDS): Coherent THz detection, pioneered by Grischkowsky (1990), revolutionized material characterization and spectroscopy by enabling precise temporal and spectral resolution. [3] Quantum Cascade Lasers (QCLs): Capasso and colleagues (2002) developed the first practical THz QCLs, paving the way for compact, tunable, and high-power THz sources. These milestones collectively bridged the "THz gap," unlocking applications in imaging, sensing, communications, and fundamental science.

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Short Bio: Xi-Cheng Zhang, Parker Givens Chair of Optics, was Director of The Institute of Optics, University of Rochester (UR), USA, a foremost institution in optics and optical physics research and education (Jan. 2012–Jun. 2017). Prior to joining UR, he pioneered world-leading research in the field of ultrafast laser-based terahertz technology and optical physics at Rensselaer Polytechnic Institute (RPI), USA ('92–'12). At RPI, he is the Eric Jonsson Professor of Science; Acting Head at Department of Physics, Applied Physics & Astronomy; Professor of Electrical, Computer & System; and Founding Director of Center for THz Research. With a B.S. degree ('82) from Peking University, China, he earned the M.S. ('83) and Ph.D. degrees ('86) in Physics from Brown University, USA. His major Honors and Awards include Edwin Land Medal, Optica-Society of Imaging Science and Technology, '25; Foreign Fellow of Chinese Optical Society (COS) '24; IRMMW-THz Society Exceptional Service Award '23; Foreign member of Russian Academy of Sciences '22; Humboldt Prize, Alexander von Humboldt Foundation (Germany) '18; Australian Academy of Science Selby Fellow (Australia) '17; Kenneth Button Prize '14 (Int. Soc IRMMW-THz); William F. Meggers Award '12 (OSA); Photonics Society William Streifer Scientific Achievement Award '11 (IEEE); William H. Wiley Award '09 (Rensselaer). He is a Fellow of AAAS, APS, COS, IEEE, Optica, and SPIE.

Holographic 3D laser printing at the speed-of-light limit

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3D laser nanoprinting has become an established manufacturing tool with many applications in optics, electronics, and the life sciences. After giving an introduction and describing the current state-of-the-art, I will present our recent work towards dramatically increasing the manufacturing speed or rate by means of a fully parallelized holographic approach at the speed-of-light limit. In these experiments, a single holographically shaped 35 fs laser pulse exposes an entire 3D microstructure via two-photon absorption in a time given by the time-of-flight of the pulse through the structure (e.g., 500 fs for a 100 μm tall polymer structure).



Short Bio: Martin Wegener completed his Diplom and PhD in physics at Johann Wolfgang Goethe-Universität Frankfurt (Germany) in 1986 and 1987, respectively. He spent two years as a postdoc at AT&T Bell Laboratories in Holmdel (USA). From 1990-1995 he was professor at Universität Dortmund (Germany), since 1995 he is professor at Institute of Applied Physics of Karlsruhe Institute of Technology (KIT). Since 2001 he has a joint appointment as department head at Institute of Nanotechnology (INT) of KIT. From 2001-2014 he was the coordinator of the DFG-Center for Functional Nanostructures (CFN) at KIT. Since 2018 he is spokesperson of the Cluster of Excellence 3D Matter Made to Order. His research interests comprise ultrafast optics, (extreme) nonlinear optics, optical laser lithography, photonic crystals, and metamaterials. This research has led to various awards and honors, among which are the Alfred Krupp von Bohlen und Halbach Research Award 1993, the BadenWürttemberg Teaching Award 1998, the DFG Gottfried Wilhelm Leibniz - 2 - Award 2000, the European Union René Descartes Prize 2005, the BadenWürttemberg Research Award 2005, the Carl Zeiss Research Award 2006, the Hector Research Award 2008, the SPIE Prism Award 2014 for the start-up company Nanoscribe GmbH, the Stifterverband Science Award – Erwin-Schrödinger Prize 2016, the Technology Transfer Prize of the German Physical Society (DPG) 2018, and the Microoptics Conference (MOC) Award 2023. In 2014, 2015, 2016, 2017, 2018, 2020, and 2021 Clarivate Analytics listed him as “Highly Cited Researcher” (top 1%). He is Member of Leopoldina, the German Academy of Sciences (since 2006), Member of acatech, the National Academy of Science and Engineering (since 2019), Member of the Hector Fellow Academy (since 2013), Fellow of the Max Planck School of Photonics (since 2019), Fellow of the Optical Society of America (since 2008), and Honorary Professor at Huazhong University of Science & Technology, Wuhan, China (since 2014).

Nonlinear 2D-Materials and vdW Metaphotonics

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In this talk, we will report recent progress on nonlinear metasurface photonics using 2D materials, from monolayer TMDCs, van der Waals crystals, stacked thin layers and metastructures, patterned perovskite spin-valley locked laser, and metasurface-enabled active emitters.

References

- [1] Nature Photonics 13, 467 (2019)
- [2] Nature 613, 53–59 (2023).
- [3] Nature Photonics 18, 1170–1175 (2024).
- [4] Nature Communications 15, 10461 (2024).
- [5] eLight 4, 16 (2024)



Short Bio: Prof. Cheng-Wei Qiu is Provost's Chair Professor in National University of Singapore. He is the recipient of President's Science Award 2023, the highest science distinction in Singapore. He was elected Fellow of Academy of Engineering Singapore, and Fellow of ASEAN Academy of Engineering and Technology. He is Fellow of APS, Optica, SPIE and The Electromagnetics Academy, US. He is Foreign Fellow of Chinese Optical Society. He is well known for his research in structured light and interfaces.

Organic Soliton Semiconductor

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In 1953, H.Inokuchi discovered the photoconductive effect of aromatic compounds and first proposed the concept of "organic semiconductors". At present, organic semiconductors are advancing toward the semiconductor industry with a market value of 600 billion US dollars. Fully exerting inherent advantages and effectively overcoming existing shortcomings constitute an essential pathway to achieve this strategic goal. A soliton is a special form of energy and a solution to nonlinear dispersive equations, which maintains its waveform during propagation with excellent structural stability. In terms of electrical conductivity, solitons in polymers such as polyacetylene can migrate freely and transport charge carriers to realize efficient electrical conduction; for instance, PBFDO exhibits an ultrahigh conductivity exceeding 2000 S/cm. In the field of organic light-emitting diodes (OLEDs), soliton waves exist in cyanine dyes, which possess superior characteristics including a high molar extinction coefficient, high luminescence efficiency, and narrow full-width at half-maximum (FWHM) emission. Taking squaraine as a typical example, its fluorescence quantum yield reaches 81.3%, the corresponding OLED achieves an external quantum efficiency (EQE) of approximately 10%, and the FWHM of deep-red emission is merely 0.1 eV. For organic photovoltaics (OPVs), materials such as Y6 display prominent soliton-like electronic structural features and deliver a high molar extinction coefficient. In the research of organic magnets, organic ferromagnets fabricated via ionization-induced reconstruction and other strategies have realized room-temperature ferromagnetism, with a Curie temperature above 400 K and a saturation magnetization up to 9.0 emu/g. Benefiting from their unique structural characteristics and comprehensive performances, organic soliton materials demonstrate tremendous application potential in diverse semiconductor-related fields, offering a novel avenue for the exploration and development of high-performance organic semiconductor materials.



Short Bio: Yuguang Ma, Academician of the Chinese Academy of Sciences and the Asia Pacific Academy of Materials, and director of the State Key Laboratory of Luminescent Materials and Devices, South China University of Technology. He has long focused on fundamental research into organic and polymeric optoelectronic materials, including their innovative mechanisms and structures. He has developed high-performance materials with independent intellectual property rights and explored new strategies to improve device performance, achieving a series of original accomplishments. Internationally, he first reported the new principle of using phosphorescent materials to boost electroluminescent device efficiency, and put forward the hot exciton mechanism as well as the new structural design principles for hybridized local and charge-transfer (HLCT) materials. He has won one Second Class National Natural Science Award and two First Class Outstanding Achievement Awards from the Ministry of Education. He has published more than 520 academic papers in major domestic and international journals, with over 18,000 citations, making original contributions to the disciplinary development of organic and polymeric optoelectronic materials and devices..

Computational Optics: A Symphony of Physics and Intelligence

Tsinghua University, China

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The convergence of physical optics and artificial intelligence is reshaping how information is acquired and processed. This talk explores two closely connected themes: computational optical imaging, where intelligence enhances sensing, and photonic neuromorphic computing, where physics enables efficient computation. We present advances in both, demonstrating improved throughput and efficiency through the co-design of physics and intelligence. Looking ahead, we discuss an emerging paradigm where sensing and computing become intrinsically coupled, with light serving as both an information carrier and a computational medium.



Short Bio: Lu Fang is a Professor of Electronic Engineering at Tsinghua University, working at the intersection of physical optics and artificial intelligence to advance next-generation imaging and computing. Her work has appeared in *Science*, *Nature*, and *Nature Photonics*, among others. She is an OPTICA Fellow and a recipient of the 2025 Falling Walls Science Breakthrough of the Year.

Track 1: Green Agriculture

From Hotspot Formation to Reliable Signal Control: Engineering SERS and Nanozyme-Based Sensing in Agricultural Systems

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Surface-enhanced Raman spectroscopy (SERS) and nanozyme-based sensing platforms offer exceptional sensitivity for detecting chemical and biological hazards in agriculture, yet translating this sensitivity into reliable performance in real-world systems remains a key challenge. This talk focuses on how nanoscale phenomena - particularly hotspot formation, nanoparticle aggregation, and surface chemistry - govern optical and catalytic responses in ways that are highly sensitive to complex sample matrices, leading to non-linear and often counterintuitive behaviour. Using representative examples from pesticide detection in food systems, it is shown that SERS performance is not simply a function of analyte concentration, but a consequence of dynamic colloidal and interfacial processes. Building on this understanding, strategies are presented to move from uncontrolled signal amplification to engineered signal generation, integrating plasmonic nanostructures with catalytic nanozymes to create multimodal sensing platforms with improved robustness and adaptability. These advances demonstrate a pathway toward reliable, field-deployable sensing systems capable of supporting real-time decision-making in sustainable agriculture.



Short Bio: Cuong Cao is a Reader at Queen's University Belfast, United Kingdom. He received his PhD degree in chemical engineering from Sungkyunkwan University in 2008. The main research interests of Dr Cao are nanoplasmonics, biosensors, and nanozyme-based analytical systems for applications in food safety, environmental monitoring, and disease diagnostics.

Green Agriculture and Sustainable Beef Cattle Breeding

Jilin Agriculture University, China

Wenfa Lyu

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Green agriculture is closely linked to food security, resource utilization, and environmental pressure, and it places greater demands for sustainable development on the beef cattle industry. However, the improvement of beef cattle breeding still faces major challenges, including slow genetic progress, low reproductive efficiency, and high production costs. Breeding technologies such as somatic cell cloning, and embryo-stage genomic selection can shorten breeding cycles, and improve the precision of selection. Here, we present an integrated breeding strategy based on embryo engineering for the development of efficient and sustainable beef cattle production systems. Moreover, modern reproductive technologies offer practical tools for developing beef cattle populations with higher productivity and resource efficiency. This strategy may provide technical support for breeding beef cattle suited to green and sustainable agriculture.



Short Bio: Wenfa Lyu, Changjiang Distinguished Professor, Scientist of the National Beef Cattle and Yak Industry Technical System. He is a professor of Jilin Agriculture University, China. He is a professor at Jilin Agricultural University, China. He has presided over more than 10 national-level research projects, including the National Key R&D Program of China.

What can high-throughput phenotyping and AI bring us?

Huazhong Agricultural University, China

Wanneng Yang

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High-throughput and precise identification of crop phenotypes is the prerequisite for comprehensively analyzing the relationship between phenotypes and genes, and for gaining a deep understanding of life processes. It is also an urgent need for cultivating breakthrough new varieties and ensuring national food security. Currently, the acquisition of crop phenotypic trait information in China mainly relies on manual completion, which has the disadvantages of low efficiency, dependence on subjective factors of operators for measurement accuracy, and poor reproducibility. The lack of original high-throughput phenotypic technology for crops greatly restricts the progress of gene function decoding and crop breeding in crops such as rice. This talk mainly introduces the research progress of the crop phenotyping group at Huazhong Agricultural University in high-throughput root phenotyping, microscopic phenotyping, robotic phenotyping, UAV, 3D phenotyping, and other technologies, as well as their applications in crop functional genomics research and genetic breeding research. This study proposes a comprehensive high-throughput multi-scale phenotypic solution and has demonstrated great potential in the functional gene mining of drought-resistant complex traits in crops such as rice, maize, rapeseed, and cotton, providing a new technology and method for crop breeding improvements.



Short Bio: Wanneng Yang received his PhD degree in Biomedical Engineering from Huazhong University of Science and Technology. He is a professor of Huazhong Agricultural University, China.

AI-Enhanced Rapid SERS Screening of Trace Organic Compounds in Complex Matrices

Xiamen University, China

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Surface-enhanced Raman spectroscopy (SERS) is a powerful analytical tool for the qualitative and quantitative analysis of trace targets. However, matrix in real samples may occupy the SERS hotspots and deviate or even overwhelm the SERS signal of targets, reducing the sensitivity and complicating target identification. Therefore, SERS analysis of real sample requires proper sample pretreatment and data extraction. Here, we present our recent efforts in intelligent SERS analysis of typical ionizable organic compounds (IOCs). Guided by pKa-tuned interactions, a liquid-liquid extraction with back-extraction (LLE-BE) method was hyphenated with SERS for weakly acidic and basic IOCs in simple water matrices. Whereas, an integrated solid-phase extraction (SPE-LLE-BE) incorporating a multi-target identification algorithm (Vis-CAD) was combined with SERS, which extended SERS applicability to complex food and biological samples. For amphoteric IOCs, a modular SPE-LLE-SALLE-NPs(p) method was coupled with a self-supervised spectral separation network (SSNet) to enable rapid and sensitive detection across multiple matrices. In a word, the AI-assisted SERS strategy is able to achieve accurate blind-sample quantification and reliable multi-component identification in complex mixtures, providing a cross-media tool for full-chain monitoring of IOCs in foods, environmental migration, and biological exposure.



Short Bio: Bin Ren is a professor in Chemistry at Xiamen University, dean of College of Chemistry and Chemical Engineering and vice director of the State Key Laboratory of Physical Chemistry of Solid Surfaces. He received his bachelor's degree in 1992 and PhD degree in 1998 from Xiamen University and started independent research work in the same university after that. He spent his sabbatical year in Fritz-Haber Institute with Dr. Bruno Pettinger as an Alexander von Humboldt fellow in 2002-2003. He was awarded

Distinguished Young Scholars by the National Science Foundation of China. He serves as an Associate Editor of Analytical Chemistry (ACS) and the advisory board member of J. Phys. Chem. And J. Chem. Phys. He received Electrochemistry Award of ACS and ISE-Elsevier Award for Experimental Electrochemistry. He is now a Fellow of the International Society of Electrochemistry and a vice Chair of Chinese Electrochemical Society. He is the principal investigator of several key national grants. His research is mainly focused on the development of Raman-based methodology and instrumentation for in situ and operando study of electrochemical systems with high time and spatial resolution. He gave several plenary lectures on international conferences, including annual meeting of electrochemical society meeting.

The use of light-based technologies in automated farming

Wageningen University & Research, The Netherlands

Frits van Evert

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Agriculture must adapt to climate change, reduce its impact on the environment, and reduce the amount of labour needed. Developing new crop cultivars and adopting new agronomic practices are options to adapt to climate change. Precision agriculture, in which crops and soils are managed on a fine spatial and temporal scale, is an option to reduce environmental impact, but, unfortunately, precision agriculture may increase labour demand. The future of agriculture lies in enhanced crop breeding and increased automation and robotization. In this talk an overview is given of how optical technologies are being used to achieve these goals.

In breeding, genotyping costs have dropped precipitously in the last two decades. Phenotyping is the current bottleneck and optical technologies are being widely used to address this issue. In precision agriculture, automation of the cycle of observing, deciding, and acting is key. An overview of optical technologies for observing and acting is given. In addition, a decision framework is presented that supports farmers by recommending actions based on automated processing of observations.



Short Bio: Frits K. van Evert is a senior researcher in precision agriculture and agricultural robotics at Wageningen University & Research. He studied Agronomy at Wageningen University (MSc, 1988) in The Netherlands and Soils at Washington State University in the USA (PhD, 1992). Following his studies he worked in Niger and the USA before settling in The Netherlands.

Laser Transmittance Spectroscopy Enables Nondestructive Single-Seed Vigor Sensing in Rice for Green Agriculture

Zhu Mingdong

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Seed vigor is a key determinant of crop emergence, growth, development, and final yield, playing an important role in green agriculture. However, nondestructive assessment of individual seed vigor has long been a technical bottleneck in seed science and the seed industry. Seed vigor is essentially determined by internal material composition. Conventional mass spectrometry destroys the seed, while germination testing alters its original state - a fundamental paradox preventing both from being obtained from the same seed. This paradox severely hinders vigor mechanism elucidation and nondestructive testing technology development. Therefore, there is an urgent need to build a bridge linking material information with vigor phenotype under nondestructive conditions. Supercontinuum laser transmittance spectroscopy, with strong penetrating ability and broad spectral coverage, holds potential as such a bridge. In this study, using naturally aged rice (*Oryza sativa*) seeds, we established a single-seed laser transmittance spectroscopy method and constructed a spectral–vigor prediction model. This model achieved over 98% accuracy in identifying high-vigor seeds of the model cultivar Zhongjiazao 17, enabling spectral data to serve as an approximate proxy for seed vigor phenotype. On this basis, by using spectral prediction to classify seeds into different vigor levels and then performing mass spectrometry on each group, we circumvented the paradox. Comparative analysis revealed that compounds including PEP and niacin show significant positive correlations with seed vigor across multiple plant species, leading to identification of a key regulatory gene, Vigor1. At the application level, this bridging technology directly addresses production challenges: we developed an engineering prototype for rice seed vigor sorting and applied it to 24 rice varieties. Field trials demonstrated that 23 of these sorted varieties exhibited significantly shortened growth periods and highly increased daily yield, achieving higher productivity with the same land and resource inputs while reducing consumption of water, fertilizers, and agrochemicals - fully embodying core principles of green agriculture. This study highlights the comprehensive value of laser transmittance spectroscopy as an optical bridge for nondestructive seed vigor assessment, mechanistic dissection, and green agricultural production.

Short Bio: Zhu Mingdong, male, Ph.D. in Agriculture, Postdoctoral Fellow in Physics (Optics). Researcher at the Hunan Academy of Agricultural Sciences / Hunan Institute of Agricultural Equipment / State Key Laboratory of Hybrid Rice, and Master's Supervisor at Hunan University and Hunan Agricultural University. Research focuses on rice genetics and breeding, as well as interdisciplinary agricultural sciences. Email: uhz_uhz@hotmail.com

Biocontrol Strains for Tobacco Disease Control

Changchun Academy of Agricultural Sciences

Yang Wenting

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Chemical pesticides have long been widely applied in agriculture due to their high efficiency, stable performance and low cost. However, their long-term and excessive application inevitably causes environmental damage. Accordingly, it is particularly urgent to explore effective alternatives to chemical pesticides.

Tobacco is an important economic crop in China, and chemical pesticides are commonly adopted to control its leaf and root diseases. To screen promising biocontrol agents for reducing chemical pesticide dependence, this study carried out screening and efficacy evaluation of antagonistic strains against tobacco diseases. The research aims to provide a theoretical basis for establishing green and efficient disease management strategies, facilitate their popularization in major tobacco-growing areas, and support the environmentally friendly and sustainable development of tobacco cultivation.



Short Bio: Yang Wenting received her Master of Agriculture degree from Huazhong Agricultural University, works at Changchun Academy of Agricultural Sciences

Mid-Infrared Technologies in Agri-Food Safety: Can Photonics Hunt a Cereal Killer?

Ulm University, Germany

Boris Mizaikoff

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Photonic technologies have seen revolutionary developments in the past decades leading from conventional optics to on-chip photonic devices. Owing to the recent advances in mid-infrared (3-15 μm ; MIR) laser technology, especially cascade laser spectroscopy (CSL) has evolved into a state-of-the-art tool for the selective and sensitive quantification of trace analytes in liquid, solid, and gaseous state in a wide variety of sensing scenarios. State-of-the-art MIR sensing platforms that benefit from cascade lasers and mid-infrared LEDs via their combination with innovative waveguide technologies providing direct access to molecule-specific information using evanescent field sensing schemes at yet unprecedented levels of sensitivity will be contrasted by strategies addressing a particularly relevant example - the detection of fungal infections in commodities and cereals via MIR photonic sensing systems ... and we will answer the question as to whether photonic technologies are indeed able to hunt a cereal killer!



Short Bio: Boris Mizaikoff is a Chaired Professor and Director of the Institute of Analytical and Bioanalytical Chemistry @ Ulm University, 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 recognition architectures, multivariate data evaluation, and applications in environmental analytics, process analysis, agri-food safety and biomedical/clinical diagnostics. He is (co)author of 500+ peer-reviewed publications and 22 patents.

Lighting in high-tech farming systems

Wageningen University, The Netherlands

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Light is the driving force for growth of plants. Light not only drives photosynthesis of plants, but also affects many other plant processes. It is not only the intensity, but also the spectrum, the timing, direction, and energy content of light that determines the responses of the plants.

Controlled environment agriculture (CEA), refers to the production of vegetable and ornamental crops in greenhouses and vertical farms. In these productions systems all the growth conditions can be well controlled leading to very high production levels can be obtained with extreme limited use of land, water, fertilisers, and pesticides. To improve the yield and quality of the plants often LED lighting is used. however, it also leads to high energy consumption.

In this talk I will briefly introduce how plants are grown in controlled environment agriculture. Then I will show how we can make smart use of all the different aspects of light (intensity, spectrum, timing, direction, heat) to control the growth, yield and quality of plants . I will discuss sensing techniques (e.g. fluorescence and thermal imaging to monitor the efficiency of plant processes and how this can be developed into autonomous cultivation systems that control the plant growth and optimize energy use efficiency.



Short Bio: Prof Dr Leo Marcelis is head of the chair group Horticulture and Product Physiology at Wageningen University, The Netherlands. This group holds a strong position in research and education on vertical farming, greenhouse horticulture and post-harvest quality

His research focuses on sustainable production of high quality vegetables and ornamentals in vertical farms and greenhouses; Leo has a strong background in plant physiology, crop monitoring, computational modelling and experimentation. He has extensively studied the physiology, growth and development of plants in order to improve sustainability and quality of crop production in greenhouses and vertical farms. LED lighting is a major theme in his research. At the moment he is leading large multidisciplinary research programmes on LED lighting, plant control, and sustainability transition in greenhouses and vertical farms in which universities and private companies cooperate.

His publications can be found here:

More info about his chair group: Horticulture and Product Physiology Group | WUR

Applications of Optical Technology in Modern Animal Husbandry

Jilin Academy of Agricultural Sciences (Northeast Agricultural Research Center of China), China

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Optical technology is a core enabler of smart animal husbandry. In optical imaging, CMOS/CCD cameras, stereo vision, ToF cameras, and laser scanning enable individual identification, body condition scoring, and behavior recognition (e.g., feeding, fighting) for health and welfare assessment. Infrared thermal imagers monitor barn and animal surface temperatures and localize the area of inflammation or injury. In spectroscopy, NIR/MIR can determine components in feed, milk, and blood; HIS, MSI and Raman Spectrum can assess meat quality and safety. Infrared and laser absorption spectroscopy enable real-time monitoring of NH_3 , CH_4 , and CO_2 for breeding environment control. SERS and colorimetry allow antibiotic multi-residue detection in dairy products. Optical imaging combined with image processing supports automated poultry tracking and UAV-based herd monitoring, achieving continuous, real-time multi-target tracking even in high-altitude cold regions. Despite its potential, widespread adoption is still limited by high cost, technical level, and complex environmental adaptability.



Short Bio: Yu-min Zhao, Ph.D., Research Scientist. He is the national expert with special government allowances, senior expert and B-class talent in Jilin Province, member of the Provincial Government's Decision-making Advisory Committee, national and provincial evaluation expert. He also serves as the Deputy Leader of the Expert Group for National Beef Cattle Genetic Improvement Program, the Leader of Expert Group for Jilin Beef Cattle Genetic Improvement Program, the Director of Jilin Beef Cattle Industry Innovation Center, the Director of the Northeast Livestock and Poultry Genetic Gene Bank of MARA. He has received 15 provincial/ministerial level awards, published over 70 scientific papers as first/corresponding author, and edited 5 books.

Technology and Instruments for Fluorescence Detection and Sorting of Third-Generation Hybrid Rice Propagation Line Seeds

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Globally recognized as an effective approach to tackling food crises, hybrid rice sees China maintaining long-standing technological leadership across the world. In recent years, guided by Academician Yuan Longping, the hybrid rice innovation team developed genetically engineered male sterile and propagation lines from conventional genic male sterile rice using genetic engineering, thereby establishing the third-generation hybrid rice technology. The technology presents outstanding heterotic performance and has secured major breakthroughs in grain yield. Genetically engineered genic male sterile line seeds are yielded through self-pollination of corresponding propagation lines. During hybrid rice seed production, it is essential to employ high-precision sorters to distinguish non-fluorescent sterile seeds from fluorescent propagation line seeds. Rigorous sorting of sterile seeds has emerged as the most prominent constraint on the large-scale practical deployment of third-generation hybrid rice technology. To break this constraint, we established a dedicated high-precision sorting technology suited to the traits of genetically engineered genic male sterile seeds of third-generation hybrid rice. A series of critical technical hurdles have been resolved, covering high-throughput dynamic optical imaging detection, weak-signal identification and image processing, and high-speed precision separation. We have developed and deployed a fluorescence detection and sorting instrument for seeds of third-generation hybrid rice propagation lines. Capable of high-accuracy separation of conventional genic male sterile seeds from maintainer line seeds, this equipment ensures that neither the male sterile lines nor the resultant third-generation hybrid rice combinations carry any transgenic elements. This pivotal breakthrough addresses a core constraint restricting the widespread deployment of third-generation hybrid rice. It carries profound implications for accelerating its nationwide extension, consolidating China's world-leading status in hybrid rice research, and safeguarding national food security.



Short Bio: Jingqiu Liang received her PhD degree in Optics from CIOMP, CAS. She is a National Grade II Research Fellow and doctoral supervisor at the State Key Laboratory of Advanced Manufacturing for Optical Systems, CIOMP, CAS. Her long-term research focuses on micro-nano optics, imaging spectroscopy techniques and instrumentation, and their applications in environmental monitoring, industrial safety monitoring, deep-sea exploration, agricultural breeding, and healthcare. She has led more than 40 scientific research projects, including National Major Scientific Research Instrument Development Projects, National Key Research and Development Program of China, and 863 programs, among others. Dr. Liang has authored over 300 papers and holds more than 100 authorized invention patents.

Research on Key Technologies and System Application of Intelligent Optoelectronics Empowering Livestock Target Performance Measurement

Changchun Institute of Optics, Fine Mechanics and Physics, China

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The development of smart livestock farming is an important development direction in the current agricultural sector. Empowering the entire life cycle of intelligent livestock breeding with advanced optoelectronic imaging and artificial intelligence technologies, we progressively realize core key technologies including visual information detection of key traits in cattle and sheep breeding based on multi-dimensional optoelectronic sensors, AI collaborative intelligent interpretation of multispectral optoelectronic images, and the construction of an edge-cloud integrated intelligent measurement system for livestock target performance. This approach enables non-contact real-time acquisition of critical trait data of cattle and sheep, such as phenotypes, body weight, behaviors, body temperature, as well as feed feeding and consumption status. It conducts AI intelligent interpretation, analysis and digital visualization of visual information, provides users with high-value trait data and scientific breeding suggestions for cattle and sheep farming. It helps breeding enterprises reduce costs and improve efficiency, optimize livestock health management, promote the quality upgrading of livestock products, and significantly advance the intelligent and modern transformation as well as industrial upgrading of cattle and sheep breeding in the agricultural industry.



Short Bio: San Zhang received his PhD degree in University of Chinese Academy of Sciences. He is an associate researcher at Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China.

From Knowledge Density to Infrastructure: A Pathway to Constructing High-Quality Agricultural Datasets

Jilin Agricultural University, China

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The effectiveness of agricultural AI depends critically on data quality, yet current agricultural data suffers from fragmentation, heterogeneity, and insufficient computability. Starting from the theory of knowledge density, we propose a novel framework for quantifying dataset quality: knowledge density emphasizes not merely data volume, but the unified assessment of concept coverage, instance richness, and mapping completeness. This framework provides quantifiable evaluation criteria for constructing high-quality agricultural datasets. Building upon this, we demonstrate how FAIR principles (Findable, Accessible, Interoperable, Reusable) and AI-Ready standards are integrated into agricultural data governance workflows, enabling systematic transformation from raw data to model-ready high-quality datasets. At the infrastructure level, we have partnered with Huawei and China Telecom to construct an edge-cloud collaborative data hub architecture: edge-side storage devices enable localized collection and gateway functions, the central data center handles data aggregation and agent deployment, and the cloud layer connects to the Haikou Computing Center and Peng Cheng Laboratory's national computing network. Based on this architecture, we have established two cross-domain data centers at Sanya Yazhou Bay and Jilin Agricultural University, achieving unified aggregation of geographically distributed heterogeneous data sources, pipeline-based processing via the Fan system, and production of high-quality datasets. This creates a closed-loop flywheel from data collection through cleaning, model training, scenario validation, and data feedback. Our work provides an end-to-end solution from theoretical measurement to infrastructure for the standardized construction of high-quality agricultural datasets.



Short Bio: Xiaohui Yuan is a Professor at the College of Mycology, Jilin Agricultural University, and a Senior Scientist at the Yazhouwan National Laboratory. He serves as a doctoral supervisor at Harbin Institute of Technology and Wuhan University of Technology. He holds a Master's degree in Computer Science and a Ph.D. in Applied Mathematics. His research focuses on Artificial Intelligence (AI for Science) and agricultural big data, with main areas including agricultural phenotyping, genomics, construction of high-quality AI ready agricultural datasets, and data infrastructure development. He has led the development of multiple national-level data platforms and has published over 60 papers in journals such as Nature Genetics, AAI, PRE, and others in the fields of biology, computer science, and mathematics.

Construction and Application Practice of Smart Agriculture Technology System at Fuxi Farm

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Addressing the insufficient refinement, intelligence and systematic technical support of traditional agriculture, this report explores the construction and application of a smart agriculture technical system based on Fuxi Farm developed by the agricultural intelligent technology team of the Institute of Computing Technology, Chinese Academy of Sciences. Integrated with IoT perception, intelligent computing analysis and automatic management and control technologies, an integrated technical system applicable to large-scale farming is constructed to realize the full-process linkage of farmland data collection, intelligent decision-making and precision operation. Verified and optimized through field practice, the system effectively remedies low efficiency, high resource consumption and extensive management in traditional agriculture. This study proposes a replicable and scalable smart agriculture application paradigm, providing technical support and practical references for the intelligent and digital upgrading of modern agriculture.



Short Bio: Yucheng Zhang Ph.D. Director of the Agricultural Intelligent Technology Laboratory at the Institute of Computing Technology, Chinese Academy of Sciences(CAS). His primary research focuses on the technological system and standardization of new generation intelligent agricultural machinery. By deeply integrating cutting-edge information technologies with agricultural equipment, he aims to achieve parallel breakthroughs in core technologies, key equipment development, and industrial application demonstrations, bridging the technological gap between China's agricultural machinery sector and global leaders in advanced farm machinery. His work explores the creation of a data-driven agricultural production model centered on third-generation intelligent agricultural machinery.

Track 2: Intelligent and Advanced Manufacturing

Optic Technologies in Semiconductor Processes

Park Systems, Rep. of Korea

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Semiconductor scaling is shifting from a purely 2D miniaturization path toward rapid adoption of 3D integration. Vertical stacking is advancing quickly because its development complexity is lower than continued 2D shrinkage. Advanced packaging reinforces this transition, functioning as an extended form of three-dimensional architecture.

As structures deepen and diversify, post-process inspection and metrology face growing challenges in accessing buried features. Fast feedback requirements in manufacturing have elevated MI technologies to essential components of process control. Yet many existing optical and non-optical methods are now confronting fundamental resolution limitations. These constraints are driving the search for new sensing approaches capable of handling complex 3D geometries.

Optical techniques remain central, but their assumptions are being tested by evolving material stacks and device layouts. Computational optics and machine-learning-based reconstruction are emerging as key enablers for extracting meaningful signals. Next-generation devices such as 3D NAND and hybrid-bonded structures demand higher sensitivity and deeper penetration. Innovative illumination strategies, polarization control, and multimodal metrology are gaining momentum as potential solutions. This presentation reviews current optical MI technologies and discusses future development directions required for advanced semiconductor manufacturing.



Short Bio: Byoungho Lee received his PhD degree in Chemistry from KAIST in 2000. Currently serving as a Senior Fellow at Park Systems, Rep. of Korea. Prior to his current role, he was Senior Fellow at Hitachi High-Tech, a Fellow at SK hynix, Director of Integrated Metrology at Nanometrics, and VP of Technologist at Ultratech. His early career began as a Principal Engineer at Samsung Electronics.

Adaptive optics and precision laser fabrication

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Adaptive optics allows for spatial control over the phase and intensity of a laser beam, making it a powerful tool to assist ultrashort pulse laser machining. Optical aberrations caused by refraction at interfaces distort the laser focus, compromising resolution and fabrication efficiency. Our research in the Dynamic Optics and Photonics Group in Oxford has shown how the aberrations can be dynamically compensated using adaptive optics, such as liquid crystal spatial light modulators, for improved manufacturing of functional devices. The adaptive optics can be further used for parallelisation or beam shaping. Many applications have benefitted from this approach, including fabrication of 3D waveguide circuits in a range of materials, fiber-based Bragg sensors for harsh environments, and diamond-based electronics. This wide range of end uses shows the expanding capabilities of adaptive optics laser processing and its potential for technological advances.



Short Bio: Prof Martin Booth is chair in Optical and Photonic Engineering at the University of Oxford. His research involves the development and application of adaptive optical methods in microscopy, laser-based materials processing and biomedical imaging. His group have developed numerous implementations of adaptive optics for aberration correction in high resolution microscopes and precision laser fabrication systems. He has held Royal Academy of Engineering and EPSRC Research Fellowships and in 2016 received an Advanced Grant from the European Research Council. In 2014 he was awarded the International Commission for Optics Prize. He was appointed Professor of Engineering Science in 2014 and Chair in Optics and Photonics in 2023. He is a fellow of SPIE, Optica, and the Institute of Physics and serves on the board of Optica. He has over 200 publications in peer-reviewed journals, over thirty patents, and has co-founded two spin-off companies, Aurox Ltd. and Opsydia Ltd. He is Co-Editor-in-Chief of Light:Science and Applications.

Physics-guided U-Net for Coherence Scanning Interferometry Signal Denoising Using Synthetic Training Data

Manufacturing Metrology Team, Faculty of Engineering, University of Nottingham, UK

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Coherence scanning interferometry (CSI) enables fast, non-contact, high-resolution surface measurement for precision manufacturing, but the per-pixel fringe signals it produces are degraded by noise that can limit measurement quality. Supervised deep learning is a powerful route to signal denoising, yet its use in CSI is constrained by data: real measurements are slow to acquire, span few surface types, and provide no noise-free reference for supervised training. We address this with a physics-based simulation that generates large, diverse datasets of paired clean and noisy CSI interferograms on demand, supplying the exact ground-truth supervision that physical measurement cannot. A physics-guided U-Net is trained on these simulated fringe signals to recover the clean signal, and is benchmarked against six classical denoising methods: Savitzky–Golay, FFT band-pass, wavelet thresholding, variational mode decomposition, CEEMDAN, and Wiener filtering—spanning the main families of signal processing, across five quality metrics. The physics-guided U-Net outperforms every classical method on all metrics, achieving roughly 13 dB Peak Signal-to-Noise Ratio (PSNR) gain and 73% Root Mean Square Error (RMSE) reduction over the noisy input, demonstrating a practical and reproducible route to deep learning enhanced optical metrology for manufacturing.



Short Bio: Ruidong Xue is a Research Fellow in the Manufacturing Metrology Team, Faculty of Engineering, University of Nottingham, working under Prof. Richard Leach on the ERC Advanced Grant project AI-SURF (£2M, 2023–2027), which focuses on AI-enhanced integrated surface metrology. His research applies machine learning and physics-informed AI to optical metrology, including digital twin development, virtual instrument simulation, and machine learning pipelines for signal denoising and three-dimensional surface reconstruction in coherence scanning interferometry, fringe projection profilometry, and related techniques.

He holds a PhD in Computer Science from Aston University, with specialist expertise in time series analysis, dimensionality reduction, and similarity search. He co-authored a comprehensive review on machine learning for optical metrology in *Measurement Science and Technology* (2024), with further peer-reviewed publications in *Measurement* and IEEE conferences. He has delivered invited talks at international institutions including Germany's National Metrology Institute (PTB) and ISPM 2025, and serves as PI and Co-Investigator on interdisciplinary projects bridging AI with metrology and the biosciences. He works closely with industry partner Taraz Metrology on translating AI-enhanced metrology into manufacturing practice.

Adaptive Optics-Assisted Through-Focus Scanning Microscopy (TSOM) for Sub-Resolution Defect Inspection and Metrology

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Non-destructive inspection of sub-resolution defects is critical in advanced manufacturing, where nanoscale features strongly affect device performance; however, conventional optical techniques are fundamentally limited by diffraction. In this work, we present an adaptive optics-assisted Through-Focus Scanning Optical Microscopy (TSOM) approach for sub-resolution defect inspection and metrology. By compensating optical aberrations, adaptive optics enhances image fidelity and improves sensitivity to subtle intensity variations induced by sub-wavelength structures. The method utilizes through-focus intensity signatures to extract quantitative information on defect geometry, including depth and morphology, without relying on prior structural models. We demonstrate its effectiveness for nanoscale defect characterization in OLED panels and semiconductor wafer patterns, achieving accurate and repeatable measurements under non-destructive conditions. In addition, the potential integration of data-driven techniques is discussed to further improve defect classification and metrology robustness. This approach provides a flexible and scalable solution for next-generation optical inspection systems in semiconductor and display manufacturing.



Short Bio: Jun Ho Lee earned his Ph.D. in adaptive optics from University College London (UCL), U.K., and is currently a professor of optical engineering at Kongju National University, South Korea. His research interests include adaptive optics for astronomical and industrial applications, with particular emphasis on semiconductor and display metrology and inspection.

Structured Light for Transverse Displacement Sensing University of Science and Technology of China, China

Zheng Xi

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In this talk, we present our recent advances in utilizing structured light and resonant nanostructures for high-sensitivity transverse displacement metrology. We focus on how engineered phase responses—originating from diverse mechanisms such as phase and polarization singularities in structured optical fields, abrupt phase transitions near sharp resonance features, and geometric phase modulation—can be strategically exploited to amplify sensitivity to minute parameter variations. Combining these concepts, we demonstrate approaches in detecting sub-wavelength transverse displacements.



Short Bio: Prof. Zheng Xi is Professor of Physics at University of Science and Technology of China. He obtained his PhD in Physics from the University of Science and Technology in China in 2014. He was a Post-Doctoral Fellow at Delft University of Technology in the Netherlands from 2014-2021, and joined the University of Science and Technology in China faculty in 2021. His research interest includes nano optics, structured light, and advanced optical metrology methods.

Superoscillation: beating the diffraction limit in the far field

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This talk presents an overview of superoscillation—a remarkable phenomenon where a band-limited wave oscillates locally faster than its highest Fourier component, defying classical diffraction limits. Tracing its historical development from Toraldo Di Francia's seminal theoretical insights to recent experimental realizations, we examine how super-oscillatory fields enable sub-diffraction focusing and imaging in the far field. Despite its promise, practical adoption faces persistent challenges: intrinsic trade-offs between spot size, energy efficiency, and sidelobe suppression, along with limited working distance and field of view. This talk highlights our recent work addressing these hurdles. We report novel wavefront shaping strategies that generate stable, sub-wavelength super-oscillatory spots in the far field while significantly improving energy concentration in the main lobe. By bridging historical foundations with engineering solutions, this talk aims to chart a path toward practical super-oscillatory microscopes and metrology systems that operate label-free and far from the sample surface.



Short Bio: Fumin Huang received his PhD degree from King's College London, UK. He is a Senior Lecturer in the School of Mathematics and Physics of Queen's University Belfast, UK. His main research interests are in the fields of plasmonics, superoscillation optics, and two-dimensional materials. He discovered optical superoscillation phenomenon in experiments of light diffraction through nanohole arrays in 2007 and was the first to use prolate spheroidal wave functions to describe superoscillation, mathematically proving that arbitrarily small optical spots can be achieved in the far field without evanescent fields.

Curvilinear OPC with AI-powered SRAF placement

Guangdong University of Technology, China

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Inverse lithography technology (ILT) is showing great potential for enhanced wafer imaging performance through curvilinear layout features. However, conventional ILT relies heavily on repetitive forward lithography simulations and iterative optimization, leading to prohibitive computational costs. Moreover, the proliferation of curvilinear sub-resolution assist features (SRAFs) substantially inflates mask data volume. To this end, we propose a hybrid curvilinear mask optimization framework that combines learning-based SRAF prediction, physics-based refinement, and compact parametric representation. First, a high-frequency-aware U-Net is trained to model the mapping from target layouts to optimized curvilinear masks, where the Sørensen-Dice loss is employed to better preserve sparse assist features and curvilinear topology. Subsequently, the neural prediction is leveraged as a warm-start initialization for physics-based refinement where parametric curve fitting and EPE-guided control point (CP) optimization are applied for data compaction. Experimental results show an inference time of 0.42s per layout, while the hybrid flow with physics refinement completes within 0.73s exhibiting further improvements in PE, EPE, and PVBand. Additionally, the B-spline-based parametric representation reduces data points by 72.6% on average, significantly alleviating downstream mask data preparation overhead without compromising lithographic imaging quality.



Short Bio: Yijiang Shen received his PhD degree from the University of Hong Kong. He is currently an associate professor at the School of Automation, Guangdong University of Technology. His research includes computational lithography, image processing, and numerical algorithms for PDEs. He serves on the Editorial Board of the Journal of Microelectronic Manufacturing and is a Senior Member of the Lithography Technical Committee. Notably, he served as the Editor-in-Chief for the "Computational Lithography Tools" chapter in the 1st and 2nd editions of the EDA Technology White Paper, organized by the EDA Ecosystem Development Accelerator. He also led the release of three group standards.

AI-Assisted Optical Proximity Correction for Faster Convergence in Semiconductor Manufacturing

Shanghai Silicon Thread Technology Co., Ltd., China

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Optical Proximity Correction is a critical but computationally intensive step in semiconductor manufacturing. It compensates for lithographic pattern distortion through iterative mask correction. As layout complexity increases, conventional OPC workflows face growing pressure in runtime, hardware cost, and engineering turnaround time.

An AI EDA tool is developed to accelerate traditional OPC convergence. It learns from historical layout-to-mask correction data and generates high-quality pre-OPC mask corrections before the conventional OPC engine starts. As a result, the traditional OPC flow can begin much closer to convergence. In representative pre-OPC correction tasks, it can complete the initial correction with about 1/10 of the runtime with lower hardware cost. The talk will discuss the technical motivation, AI model design, workflow integration, and its potential role in practical computational lithography workflows.



Short Bio: Mr. Jing Fu is the CEO of Silicon-Thread Technology, an AI EDA company focused on manufacturing EDA. He received his B.Eng. in Telecommunication Engineering from the University of Liverpool and his M.Sc. in Microelectronics from Newcastle University.

From 2013 to 2016, he worked as a Design Engineer at PDF Solutions, where he developed yield solutions for process nodes ranging from 28 nm to 10 nm. In 2016, he joined Cadence as a Foundry Solutions R&D engineer, working on RTL-to-GDSII reference flows for advanced semiconductor technologies. In 2018, he joined Siemens EDA, supporting foundry customers with DRC, DFM, OPC, and MDP solutions. From 2020 to 2025, he worked at domestic EDA companies as a product manager and later as an AE director, contributing to the development and deployment of OPC and MDP toolsets.

At Silicon-Thread Technology, he currently leads the development of AI-assisted OPC and data-centric manufacturing EDA tools and workflows.

A Unified Abbe-Hopkins Framework for Source-Mask Optimization in Advanced Lithography

Guangdong University of Technology, China

Ying Wang, Shuting Cai*, and David H. Wei*

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Accurate simulation of partially coherent imaging is crucial for computational lithography, with Abbe and Hopkins as the two main formulations being used. Although the Abbe and Hopkins models are theoretically equivalent, choosing either model in practical simulations (e.g., source-mask optimization (SMO)) rarely yields consistent results due to inherent differences in the numerical treatment of the source and pupil functions, including representation, discretization, and truncation. This mismatch hinders convergence to the global optimum and degrades lithography performance. Moreover, existing SMO methods still perform full-field imaging calculations during the optimization stage, resulting in significant computational redundancy and reduced efficiency. To address these challenges, we propose an Abbe-Hopkins-consistent modeling framework and enhance the SMO implementation by incorporating a pointwise sampler without using the expensive transmission cross coefficient (TCC). Our framework supports both Abbe and Hopkins modeling within a single architecture, employing identical numerical representations of the illumination source and projection lens. A linear operator is constructed to ensure consistency between the Abbe and Hopkins models through a unified point spread function (PSF) representation, with the PSF band-limited in both spatial and frequency domains. In this way, the proposed method achieves efficient SMO at a high level of numerical accuracy.



Short Bio: Ying Wang is currently a PhD candidate at the School of Integrated Circuits, Guangdong University of Technology. Her research focuses on Computational Imaging and Computational Lithography.

Efficient Thermal Prediction and Reduced-Order Modeling for Highly Integrated Systems

Xiamen University, China

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To address the critical thermal challenges in highly integrated electronic systems such as Chiplets and SIW antenna arrays under complex power excitations, we present efficient reduced-order modeling frameworks based on dynamic mode decomposition (DMD) and its advanced variants. For heterogeneously integrated Chiplet systems with multi-scale geometric features, a parametric DMD method is proposed to extract low-rank structures that capture spatio-temporal correlations, extending the capability to handle variations in convection coefficients and thermal conductivity with a 4 to 9 times speedup over COMSOL. To further capture localized transient nonlinearities and external power inputs, the DMD is combined with the deep learning long short-term memory (LSTM) method. In this framework, DMDc is utilized to construct a low-dimensional baseline model for the global thermal evolution, while LSTM is employed to learn nonlinear residuals and compensate for modal truncation errors. Numerical results show that the hybrid method achieves high-fidelity thermal reconstruction and robust dynamic prediction, providing a 7 times speedup over COMSOL. These results offer a comprehensive and cost-effective paradigm for the active thermal management and design optimization of next-generation electronic and microwave systems.



Short Bio: Na Liu received her PhD degrees in computational mathematics from the University of Chinese Academy of Sciences, Beijing, China, in 2013. From 2013 to 2017, she was a Postdoctoral Researcher at the Institute of Electromagnetics and Acoustics, Xiamen University. Since March 2017, she is an Associate Professor with the Institute of Electromagnetics and Acoustics, Xiamen University. Her research interests include computational electromagnetics, especially the fast and efficient methods for complex media and their applications in multiphysics simulations.

Computational lithography empowered by AI

Beijing Institute of Technology, China

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Driven by Moore's Law, the critical dimension of integrated circuits has gradually approached the physical limit of lithographic imaging resolution. In this context, computational lithography must be adopted to improve the lithography imaging resolution and fidelity, thereby expanding the process window and enhancing the yield. However, with the continuous increment of density and scale of integrated circuits, the complexity of computational lithography algorithms has grown substantially, posing a severe challenge to their implementation efficiency. Artificial intelligence (AI) offers a new approach for developing fast and accurate computational lithography simulation and optimization methods. This report first outlines the fundamental principles of computational lithography, the characteristics of machine learning and deep learning, and their applications in computational lithography. Subsequently, we discuss fast inverse lithography methods based on model-driven deep learning approach and low-cost self-supervised training strategy. It shows that AI technologies are expected to significantly improve the efficiency of computational lithography algorithms, while maintaining the lithography imaging quality.



Short Bio: Xu Ma received the B.S. degree in electrical engineering from Tsinghua University, and the Ph.D. degree in electrical and computer engineering from University of Delaware. He was a Postdoctoral Scholar in electrical engineering and computer sciences with the University of California, Berkeley. He is currently a Professor with the School of Optics and Photonics at Beijing Institute of Technology. His research interests include computational lithography, computational imaging, and optoelectronic image processing. He is the first author of the book "Computational Lithography" (Wiley and Sons, 2010). He published more than 160 papers, and hold more than 60 patents. He is the Senior Member of OSA, IEEE and SPIE.

Direct Laser Printing of 3D Hierarchical Ni(OH)₂/NiO Microarchitectures with adjustable porosity

University of Science and Technology of China, China

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Transition-metal hydroxides and oxides have been extensively employed in optoelectronic and electrochemical devices; however, achieving precise control over their 3D microarchitecture and morphology remains a significant challenge for microscale device fabrication. Herein, we present a laser-programmable manufacturing strategy that enables the high-precision printing of Ni(OH)₂/NiO microstructures with highly tunable porosity. By using a continuous wave laser to generate a highly localized thermal field, spatially confined nucleation and rapid hierarchical assembly of nanosheets are achieved. Uniquely, this method allows for seamless switching between additive growth and acid-mediated subtractive dissolution, facilitating the dynamic construction of complex 3D geometries. By systematically tuning the laser parameters and ink coordination chemistry, the porosity of the printed Ni(OH)₂ and NiO microstructures can be precisely regulated. With dense structures, microdevices with programmable structural colors spanning a broad color gamut are realized. Furthermore, the printed porous structures demonstrate exceptional performance as integrated micro-sensors with high thermal sensitivity (B-value up to 8575 K) and rapid ethanol gas detection. This work provides a highly versatile, mask-free platform for the on-demand microfabrication of multifunctional transition-metal oxide devices.



Short Bio: Wenxiang Hou is currently a Ph.D. candidate in the Department of Precision Machinery and Precision Instruments at the University of Science and Technology of China (USTC), under the supervision of Prof. Liang Yang. His research mainly focuses on the laser micro-nano manufacturing technology of inorganic functional materials.

Track 3: Interdisciplinary Forum

Organic Electrochemical Meta-Displays

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The evolution of display technologies has been driven by the ability to actively control light with ever-increasing spatial resolution and functionality. From liquid crystal panels to micromirror arrays, programmable optical elements have transformed how we generate, manipulate, and interact with visual information. Metasurfaces, ultrathin arrays of subwavelength nanostructures, offer a fundamentally new route to shaping optical wavefronts, enabling compact and highly efficient flat optical systems. However, translating static metasurface functionality into fully programmable and electrically addressable meta-displays remains a central challenge.

In this talk, we will present organic electrochemical metasurfaces as a new platform for intrinsically active meta-optics. By integrating redox-active organic materials with nanoscale photonic structures, we enable dynamic and reversible control of optical responses at the level of individual metasurface pixels. This approach establishes a pathway toward electrically programmable, low-voltage, and high-density meta-displays that operate as self-contained active optical devices rather than hybrid modulation systems. These organic meta-displays support real-time, user-driven holographic functionalities, illustrating how electrochemical material physics can be directly translated into system-level optical programmability. More broadly, this work points toward a future in which organic materials and meta-optics converge to enable compact, energy-efficient, and interactive flat photonic technologies.



The speaker profile for Laura Na Liu features a portrait on the left and a blue banner at the top right containing logos for 'Light Science & Applications', 'iCANX', and the University of Stuttgart. The profile includes a 'Personal Introduction' section with a detailed biography in Chinese.

个人简介

刘娜教授，2009年获德国斯图加特物理学博士学位。2010-2012年在美国加州伯克利分校和莱斯大学分别做博士后研究以及访问教授。2012-2015年独立建组于德国马克斯·普朗克智能系统研究所。2015-2020年成为德国海德堡大学物理系终身教授。2020年加入斯图加特大学，现任第二物理所所长和讲席教授。

刘娜

德国斯图加特大学

Analog computing with nonlinear flat optics

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Costantino De Angelis
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We demonstrate a programmable nonlinear optical computing platform where structured light holographically writes the nonlinear polarization of an unpatterned GaAs film, enabling reconfigurable analog and nonlinear computations, including mode transformation, feature extraction and quadratic kernels. Our results demonstrate that a simple, unpatterned nonlinear film can be transformed into a programmable nonlinear processor, with its behavior rewritten in real time by structured light. With this approach, a single film can execute diverse tasks ranging from beam shaping and mode conversion to analog and fully nonlinear operations. This versatility surpasses the capabilities of conventional $\chi^{(2)}$ devices, positioning our platform as a foundational technology for next-generation nonlinear photonic systems, from intelligent imaging and feature extraction to optical neural networks and ultrafast computational processors.



Short Bio: Costantino De Angelis received his PhD from the University of Padova (1993) where he served as Assistant Professor of Electromagnetic Fields and Photonics. In 1998 he joined Brescia University where he is Full Professor of Electromagnetic Fields and Photonics since 2004. He is the head of the NORA group at the University of Brescia (<https://nora.unibs.it/home>) and his current research interest include nonlinear optics,

nanophotonics, and optical metamaterials.

He is a Fellow of OPTICA (the Optical Society of America).

Hyperbolic surface polaritonics on bulk crystals

Nanyang Technological University, Singapore

Guangwei Hu

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Confining Mid-IR photons ($\sim 10\ \mu\text{m}$) at nanoscale is important to develop Mid-IR nanophotonics. There are several emerging platforms, including vdW materials. One can further apply the twisted stacking to control their propagations. However, the mass production of practical Mid-IR nanodevices based on low-dimensional materials are not available yet; besides, the propagation distance is limited. Here, I will discuss our recent efforts on study hyperbolic surface polaritonics with natural bulk crystals. I will first show how new modes can be sustained in those natural crystals, such as calcite. Herein, the highly confined Mid-IR polaritons can propagate like a ray, in a long distance ($\sim 20\ \mu\text{m}$) at the surface of bulk crystals. Moreover, I will show how the crystal symmetry is important to regulate the polaritonic behaviours. Specifically, we will discuss how monoclinic crystal can support the asymmetric propagation of polaritons, due to the necessary non-Hermitian nature of the system, and provide the experimental evidence of the system. Last, we discuss our recent results of hyperbolic polaritons at the surface of non-hyperbolic bulk crystals. Our theoretical exploration and experimental efforts would be very important for the mass-producible platforms based on natural bulk crystals for mid-IR nanophotonics and hyperbolic polaritonics.



Short Bio: Dr. Guangwei Hu is the Nanyang Assistant Professor in School of Electronic and Electric Engineering, Nanyang Technological University in Singapore. His research interest is nanophotonics, including theory, numerical modelling, and materials such as 2D materials, for broad applications including bio-imaging, information processing, energy and others. He has published more than 100 papers, including *Nature* (5), *Science*, and many others. His work has been featured as the Top 10 Breakthrough in Physics of 2020 by *Physics World*, *Optics and Photonics News* (Year of Optics in 2021), China's Top 10 Breakthrough in Optics in 2021, and many others. He received Early Career Awards in Nanophotonics (2023), MIT Technology Reviews Innovators Under 35 of 2022 (China), *Forbes* 30 Under 30 of 2023 (Asia), Rising Star of Light in 2020 by *Light: Science & Applications*, NUS President's Graduate Fellowships and various other awards.

Mie-assisted guided-mode excitation in synthetically fabricated silicon metawires

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We report guided-mode excitation in synthetically fabricated silicon metawires: periodically diameter-modulated silicon nanowires produced by ENGRAVE. In this process, spatially encoded doping during vapor–liquid–solid growth is converted into deterministic axial geometry through selective etching, enabling optical functionality to be defined directly during synthesis without post-growth lithography. The resulting diameter modulation forms a one-dimensional geometric superlattice with deeply subwavelength features. Optical measurements show that the modulated segments act as Mie-scattering elements that couple optical excitation into guided modes of the metawire, producing responses absent in uniform silicon nanowire waveguides. These results establish synthetic geometry encoding as a route to embedding waveguiding and mode-coupling functions within individual nanowires, positioning metawires as a compact platform for integrated nanophotonics and highly miniaturized photonic devices.



Short Bio: Kyoung-Ho Kim received his PhD degree in Physics from Korea University in Korea. He is an associate professor in the Department of Applied Physics at Kyung Hee University, Korea.

Recent progress of the blocked impurity band VLWIR photodetector

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Infrared detection technology is essential for answering fundamental questions about the universe—such as its origin, the formation of galaxies, the search for habitable exoplanets, and the possible existence of extraterrestrial civilizations. In deep space, most celestial bodies and debris have extremely low surface temperatures, often below 200 K, and in some cases as low as 50 K, 20 K, or even just a few kelvins. These targets also emit very weak infrared signals at wavelengths beyond 14 micrometers. Observing such faint and distant objects is akin to spotting shadows in the dark. To meet these challenges, very long wavelength infrared (VLWIR) detectors with high sensitivity and low noise are crucial. In this talk, we will introduce recent research progress on silicon-based blocked impurity band (BIB) photodetectors with cutoff wavelengths extending beyond 20 micrometers. These devices are optimized for deep space exploration and astronomical observations of ultra-cold, low-radiation targets. The combination of impurity band engineering and micro-optical structures enables enhanced quantum efficiency and reduced dark current, paving the way for next-generation spaceborne infrared sensing systems.



Short Bio: Peng Wang received his PhD degree in Materials Science and Engineering from Anhui University. He is a professor of Shanghai Institute of Technical Physics, Chinese Academy of Sciences, China. His main research areas are infrared photodetection mechanisms, devices, and applications. He is a recipient of the National Science Fund for Excellent Young Scholars, member of the Youth Innovation Promotion Association of CAS, and was selected for the Youth Talent Support Project of the China

Association for Science and Technology. Dr. Wang has received the First Prize of the Shanghai Natural Science Award (third contributor) and the IEEE ICOCN Young Scientist Award. He serves on editorial boards of journals such as *Infrared and Laser Engineering*, *Chinese Optics Letters*, *Sensors*, and *Journal of Infrared and Millimeter Waves*. He has published over 100 papers, including 45 SCI-indexed as first or corresponding author in *Light Science & Applications*, *Science Advances*, *Nature Communications* and *Advanced Materials*, with more than 13,900 citations and an h-index of 60. He holds 13 Chinese invention patent applications, 5 of which have been granted.

Electrically tunable quantum localization and transport of interlayer excitons in an artificial superlattice

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Excitons in two-dimensional semiconductors provide a promising platform for exploring interacting bosonic quantum systems, but their spatial localization has so far relied on intrinsic disorder or moiré potentials that lack tunability. Here, we demonstrate electrically programmable quantum localization of interlayer excitons in an artificial superlattice defined by nanopatterned electrodes. A spatially nonuniform vertical electric field generates periodic electrostatic potentials via the linear Stark effect, enabling deterministic confinement of excitons into one-dimensional and zero-dimensional quantum sites. We observe giant optical nonlinearities at nanowatt excitation powers and spectroscopic signatures of single-exciton trapping and energy quantization arising from confinement-enhanced dipolar interactions. Time-resolved imaging further reveals electrically tunable exciton transport, including a transition from localized to delocalized regimes driven by the interplay of confinement and interactions. These results establish a foundation of a versatile solid-state platform toward programmable excitonic quantum matter and simulation of bosonic many-body physics.



Short Bio: Qitong Li is an Assistant Professor in the Department of Electronic Engineering at Tsinghua University since March 2026. Prior to this appointment, he was a postdoctoral researcher working with Prof. Tony F. Heinz in the Department of Applied Physics at Stanford University. He received his B.S. degree in Physics from Peking University in 2016, and his Ph.D. degree in Materials Science and Engineering from Stanford University in 2022 under the supervision of Prof. Mark L. Brongersma. His research focuses on leveraging customized nanostructured platforms and emerging low-dimensional quantum materials to achieve precise control over extreme and quantized photon–electron interactions, enabling more efficient transfer of energy and information between photonic and electronic carriers.

Dr. Li has published more than 20 papers in peer-reviewed journals, including publications as first or corresponding author in *Science*, *Nature Photonics*, *Nature Nanotechnology*, *Nature Communications*, and *Optica*. He has been invited to deliver seminars at many leading research institutions worldwide, including Harvard University, California Institute of Technology, Columbia University, Lawrence Berkeley National Laboratory, and Advanced Science Research Center (ASRC) at CUNY. His honors include the 2024 “Rising Stars of Light” award, the 2020 MRS Graduate Student Award, the 2020 O. Cutler Shepard Award from Stanford University, and the 2021 Chinese Government Award for Outstanding Self-financed Students Abroad.

Tailoring Coherence for Dynamic Sensing

Soochow University, China

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Light field manipulation spans multiple dimensions, including phase, polarization, and coherence, with coherence being a fundamental property that characterizes the statistical behavior of optical fields. When propagating through complex environments, the first-order field properties (e.g., phase and polarization) are highly susceptible to disturbances along the transmission path. However, by incorporating coherence control, the second-order statistical properties of partially coherent light fields—such as the degree of coherence and cross-spectral density—become considerably more robust against environmental fluctuations, offering a significant advantage in mitigating turbulence-induced effects. This report will highlight two key topics: robust optical information transmission enabled by the manipulation of spatial coherence structures of light fields, and the partially coherent rotational Doppler effect along with its detection applications in complex environments.



Short Bio: Xingyuan Lu is an Associate Professor at Soochow University. She received her B.S. in Physics and M.S. in Optics from Soochow University, and earned her Ph.D. from Soochow University through a joint training program with the University of California, Los Angeles (UCLA). Her research interests include light field manipulation, singular optics, and coherent diffraction imaging. Dr. Lu has published over 50 papers in optical journals such as *Light: Science & Applications* and *Advanced Photonics*, and holds 14 authorized invention patents. She has served as Principal Investigator for a General Program and a Young Scientists Fund project of the National Natural Science Foundation of China (NSFC).

The Intersection of Quantum Microprocessors and AI Creates a Dynamic “Arms Race”

Institute of Quantum Technology (IQT) The Hong Kong Polytechnic University, Hong Kong

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This talk is to explore the effect of quantum computing on data science and AI, looking at the fundamental concepts of quantum computing and the key terms used in the field. It also covers the challenges that lie ahead for quantum computing and how they can be overcome. Quantum computing involves specialized computers that solve mathematical problems and run quantum models that are quantum theory principles. This powerful technology allows data scientists to build models related to complex processes such as molecular formations, photosynthesis, and superconductivity. Information is processed differently from regular computers, transferring data using qubits rather than in binary form. Qubits are vital in terms of delivering exponential computational power in quantum computing as they can remain in superposition. Using a wide range of algorithms, quantum computers can measure and observe vast amounts of data. The necessary algorithms will be input by the user, and the quantum computer will then create a multidimensional environment that makes sense of the various data points to discover patterns and connections. Quantum machine learning and quantum artificial intelligence are two underappreciated but fast-growing fields within data science. This is because machine learning algorithms are becoming far too complex for traditional computers and require the capabilities of quantum computing to process them effectively. Eventually, this is expected to lead to major advancements in artificial intelligence.



Short Bio: Dr Ai-Qun Liu (A. Q. Liu) is a STEM chair professor in the Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic University (PolyU). Currently he is Director of research Institute for Quantum Technology (IQT). His research interests include quantum computers and quantum communication, photonic device and fabrication. He has published over 400 peer-reviewed papers and also received multiple prestigious awards and honors including Singapore Prestigious Engineering Achievement Award. He was elevated to a Fellow of Engineering Academic Singapore, and also SPIE Fellow, OSA Fellow and RCS Fellow.

Scalable Photonic Materials for Radiative Cooling and Sustainability

The University of Hong Kong, Hong Kong, China

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Structured photonic materials enable energy-matter interactions to be engineered across scales, linking nano-optical design with practical energy and environmental technologies. In this talk, I will discuss scalable micro-/nano-structured materials that control photons, phonons, and thermal radiation, with emphasis on passive daytime radiative cooling. Glass-polymer hybrid metamaterials and radiative-cooling structural materials combine high solar reflection with selective thermal emission through the atmospheric window, enabling cooling without electricity. I will also discuss photon-managing films and metasurfaces for buildings, solar-energy systems, greenhouses, water management, and urban thermal control. These examples show how nanophotonics, radiative heat transfer, and scalable manufacturing can be integrated into deployable sustainability technologies at the climate-water-energy-food nexus.



Short Bio: Professor Xiaobo Yin is Vice-President and Pro-Vice-Chancellor (Global) (Interim), Chair Professor of Mechanical Engineering, and Professor of Physics (by courtesy) at The University of Hong Kong. He also directs the Jockey Club STEM Laboratory of Advanced Materials and Intelligent Manufacturing for Energy and Sustainability and the HKU Kadoorie Centre. He received his PhD in Electrical Engineering from Stanford University after BS and MS degrees in Physics from Nanjing

University. His research spans nano-optics, nanophotonics, metamaterials, radiative heat transfer, scalable manufacturing, and sustainability technologies. He is a Fellow of Optica and SPIE, an Xplorer Prize recipient, and a Clarivate Highly Cited Researcher.

AI-Driven Inverse Design of Thermal Metamaterials

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Thermal metamaterials have emerged as a powerful platform for tailoring electromagnetic responses in the mid-infrared (MIR) regime, enabling diverse applications such as molecular sensing, passive radiative cooling, thermal camouflage, and night vision. Despite their vast potential, designing thermal metamaterials remains fundamentally challenging due to the high-dimensional, non-intuitive relationship between structural geometry and spectral response, particularly for multifunctional and multispectral requirements. To efficiently navigate the immense design space, we employ two complementary machine learning frameworks; i) a factorization machine-simulated annealing-based active learning for discovering complex spectral responses with minimal data, enabling optimization of high-dimensional, discrete design spaces and ii) OptoGPT leveraging pretrained generative architecture to significantly accelerate inverse design. Using these AI-driven approaches, we demonstrate a range of multifunctional thermal metamaterials with tailored multispectral responses. These include i) energy-saving cooling windows that are visibly transparent, highly reflective in the near-infrared to suppress solar heating, and emissive in the MIR for efficient thermal radiation, (ii) visible-thermal dual-band camouflage that exhibits prescribed colors in the visible while minimizing thermal radiation in the MIR, and (iii) multi-wavelength MIR absorbers featuring high-Q resonances at multiple target wavelengths for selective spectroscopy.



Short Bio: Sun-Kyung Kim received his PhD degree in Physics from KAIST in Korea. He is a tenured professor in the Department of Applied Physics at Kyung Hee University, Korea.

Harvesting energy from the Cold Universe: The missing piece in the renewables puzzle?

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On a bright, warm day, more than 1TW of installed solar power capacity worldwide works tirelessly to light up our houses, charge our cars, power our business and in general, to seamlessly support our daily lives. This remarkable achievement has been made possible by over 60 years of advancements in photovoltaics, which convert the incoming solar radiation into useful energy. However, for the Earth to maintain a stable temperature, it must dissipate heat at a rate roughly equal to the power it receives from the Sun. This natural thermoregulation process, known as radiative cooling, taps into the infinite heat capacity of the ultracold Universe to release excess heat from Earth's surface into outer space. Recently, scientists have recognised that this vast, outgoing heat transfer could be harnessed, offering a new renewable pathway toward sustainable energy transition. This talk will cover the fundamentals of radiative cooling, will discuss recent advances in the photonic innovations lab, and will conclude with practical applications including sustainable horticulture and plant growth, passively cooling our spaces and vehicles, generating electricity in the dark, co-harvesting energy from the Sun and outer space and more.



Short Bio: Ioannis is Professor of Photonics and Nanofabrication in the Department of Electronic and Electrical Engineering at UCL and leads the Photonic Innovations Lab. Before joining UCL, he worked at CERN (European Organization for Nuclear Research) and Sharp Laboratories of Europe. His research focuses on light-matter interactions at the micro- and nanoscale, with applications spanning mid-infrared photonics, radiative cooling, luminescent solar concentrators, biomedical devices, climate resilient-agriculture and more. He has been the recipient of multiple awards including four grants from the European Research Council and two Marie-Curie fellowships. Ioannis also holds a diverse portfolio of 14 patent families in areas including optoelectronic systems, liquid crystal displays, photonic security features, biomedical devices, and radiative cooling technologies.

Terahertz Time-Resolved Nonlinear Optics of Hybrid Medium: From Gas to Liquid

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I discuss the current state of nonlinear optical research related to the interaction of pulsed terahertz radiation with "complex media" in various phase states. By "complex media," we mean systems consisting of "multiple components" with different permittivities, nonlinear responses, and multicomponent dipole moment relaxation dynamics after photoexcitation. This research began worldwide approximately five years ago and pertains to the interaction of half-period terahertz radiation pulses with nanocomposite media. At long terahertz wavelengths, studying the anomalous sensitivity to the nanoscale size of medium components presents an interesting scientific challenge.

In the linear approximation, such media are described by effective medium models, which can also be applied to the analysis of discrete matter in liquid flows at up to supersonic velocities. For the gas phase, we consider gas jets containing nanoscale clusters of noble gases and freon. We experimentally implement pump-probe schemes using terahertz and femtosecond optical pulses. The excitation intensity is low enough to study all stages of nanoparticle ionization. Photoexcitation of clusters enables real-time control of nonlinear optical properties. For condensed-phase systems, we consider nanoparticle solutions in liquids, using water and liquid nitrogen as demonstration examples.

We report the delayed enhancement of terahertz-induced second harmonic generation (TISH) from a noble gas jet containing clusters undergoing hydrodynamic expansion in response to an ultrashort pump pulse. The polarization and time dependence of the TISH signal indicate anisotropic cluster expansion, with the anisotropy dynamics differing between the gas and liquid phases. We discuss a theoretical description of TISH in terahertz radiation interactions with clusters based on the model of uniformly expanding nanoplasma.



Short Bio: Alexander Shkurinov in 1985 graduated with honours from the Lomonosov Moscow State University (MSU), Moscow, Russia. He received his Ph.D. degree in Physics from MSU in 1988. Since 2004 he is a full-time Professor at the Department of Physics of the MSU where he is Head of the Laboratory of terahertz optoelectronics. In 2025 he is elected as the member of Russian Academy of sciences. The research interests of Alexander Shkurinov are mainly centered around the development and application of femtosecond laser techniques, time-resolved spectroscopy of molecules in liquid phase, nonlinear optics and THz techniques and spectroscopy. The results obtained by Alexander Shkurinov have been published in more than 350 scientific papers in peer-reviewed journals.

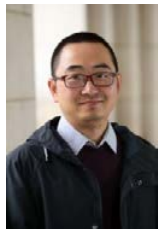
Inkjet-Printed Colloidal Quantum Dots as Solution-Processed Quantum Solids for Lighting and Sensing

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Colloidal quantum dots (QDs) are zero-dimensional semiconductors in which quantum confinement, surface states, and interparticle coupling govern electronic structure and charge transport. When assembled into dense films, QDs form solution-processed quantum solids whose optoelectronic response—relevant to lighting and sensing—is dictated by nanocrystal faceting, interfacial energetics, and mesoscale morphology. In this talk, I will discuss the physics of inkjet-printed, lithography-free QD quantum solids, from nanocrystal formation to collective transport in pixelated architectures. Combining simulations with electron microscopy, I show how nanofaceting during synthesis and post-processing controls interfacial curvature and electronic coupling. I then demonstrate how solvent- and vapor-mediated assembly enables controlled percolation pathways and distinct transport regimes in printed films, directly governing radiative recombination and photocarrier extraction. Finally, I discuss cooperative ion and charge transport in interconnected QD networks, illustrating the emergence of collective electronic behaviour as QDs transition from isolated quantum systems to functional quantum solids for light emission and detection.



Short Bio: Bo Hou (FInstP, FRMS, FHEA) is a Reader Professor at the School of Physics and Astronomy, Cardiff University, UK. He received his PhD degree from the University of Bristol (2010–2014) and worked as a postdoctoral researcher at the University of Oxford (2014–2018, Wolfson College) and a Senior Research Fellow at the University of Cambridge (2018–2020, St Edmund's College). He is heading a research group focused on growing quantum dots (II-VI and III-V) for PV, active lighting, sensing and electron microscopy studies of these fascinating quantum solids. He has received several awards from EPSRC, Royal Society, BBSRC, Leverhulme and Medr and also an associate member in the UK National Compound Semiconductor Applications Catapult.

Few mode to single mode fiber converter based on micro lens array and fiber bundle for astronomical spectral observation

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Optical fiber technology has evolved into an indispensable core component of modern astronomical instrumentation, profoundly promoting the development of high-precision spectral observation, adaptive optics (AO) correction, and multi-channel integrated detection in ground-based and space-based astronomical systems. Usually, The multimode fibers are chosen to get light from the telescopes due to their large cores. But, the large cores don't fit to the requirement of high spectral resolution.

Benefiting from the rapid development of micro-nano photonics and semiconductor integration technology, chip-based integrated spectrometers have emerged as a novel lightweight detection solution for modern astronomical observations, featuring miniaturized structure, low power consumption, high integration, and excellent spectral response stability. Only inconvenient limit is that the the chip spectrometers need fit to singlemode fibers.

Even the AO technology is introduced to reduce the size of the image spots, the coupling efficiency to a singlemode fiber is still low. Some new fiber components, such as photon lanterns, were developed, but they were not applied widely due to complexly fabrication. A Fewmode to singlemode fiber converter is proposed here to transfer light from a fewmode fiber to a serials of singlemode fibers.

The fewmode fiber is used to collect star light after an AO system. The core diameter of the fewmode fiber can cover the corrected star image. In the fiber converter the light from the fewmode fiber propagates to a microlens array. Every microlens unit images the output end of the fewmode fiber to a smaller spot, which fits to a singlemode fiber core. All the microlens units are aspherical designed to reduce the aberration.

The best material of the microlens array is the quartz glass, same as the materials of fiber cores. But it is difficult to build an aspherical quartz microlens array. A polymer 3D printed aspherical microlens array was designed to test the effectiveness of the fiber converter. More experiments need to be done to optimize the design in the future.

There are many components could be designed and fabricated based on the microlens array and fiber bundle. It is a good way to transform light modes.



Short Bio: Weimin Sun is a professor of Harbin Engineering University. His research area includes fiber optics, astrophotonics and optical measurement. He serves as an executive member of the Optoelectronic Technology Special Committee of the Chinese Optical Society, an executive member of the Optical Education Special Committee of the Chinese Optical Society, a member of the Ocean Optics Special Committee of the Chinese Optical Engineering Society, a member of the Ocean Information Network Special Committee of the Chinese Optical Engineering Society, a member of the Opto Mechanical and Electrical Technology and System Integration Branch of the Chinese Instrument and Meter Society, an executive member of the Heilongjiang Optical Society and Instrument and Meter Society, and a member of the Technical Guidance Committee for the GTC High Resolution Ultra Stable Spectrometer Project in Spain. Since

2009, he works on astronomy and holds 2 key projects and 4 general projects of National Natural Science Foundation of China. He built 3 fiber integral field units, which consist 242, 1364 and 8064 fibers. Some fiber aimers were designed and fabricated for LAMOST. All these components are based on the combination of microlens array and fiber bundle. He published more than 200 SCI papers and obtained more than 50 invention patents.

Towards long distance quantum communication with deterministic single photon sources

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This talk presents three recent works that collectively advance deterministic single-photon sources toward practical long-distance quantum communication. We first highlight a landmark field demonstration of intercity QKD using a deterministic quantum dot source, achieving secure key distribution over a 79 km deployed fiber link with low error rates and record key efficiency. This work shows that deterministic emitters can significantly improve loss tolerance and extend achievable distances compared to conventional weak-coherent sources.

To overcome phase instability over long distances, we successfully integrated telecom C-band QDs with self-stabilized time-bin encoders. This setup enabled QKD over 120 km of standard optical fiber, while maintaining a Quantum Bit Error Rate (QBER) below 11% for over six hours. This achievement represents a milestone in the stability and secure key rate (SKR) of true SPS systems in fiber networks.

Finally, our latest research introduces an ultra-stable, low-error dynamic polarization encoding scheme. This approach allows for precise manipulation of single-photon states with high fidelity, ensuring robust performance in fluctuating environmental conditions.

In summary, deterministic single-photon sources are evolving from laboratory prototypes into key enabling components for long-distance quantum communication, with promising prospects for integration into quantum repeater architectures and future large-scale quantum networks.



Short Bio: Fei Ding is a W3 full professor at Leibniz University Hannover, where he also takes the role of the Board member at the Institute for Solid State Physics and the Laboratory of Nano and Quantum Engineering. Prof. Ding received BSc degree in 2003 from Hefei University of Technology. In 2009 he obtained PhD degree from the joint doctoral promotion program between Max Planck Society Germany and Chinese Academy of Sciences. From 2010 to 2012 he was a Marie Curie Fellow at IBM Zurich Research Laboratory. In 2012 he became a group leader in IFW Dresden and then in 2016 moved to Hannover as a full professor. His group is funded by a number of national and EU projects, including the highly prestigious ERC grants for 3 times (Starting, Consolidator, and Proof-of-concepts).

Ambient Droplet Reactor: An Analytical Platform for Single-molecule and Characterizations

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Droplet evaporation on superhydrophobic surfaces offers a powerful molecular enrichment mechanism by leveraging the movement of the three-phase contact line. This movement prevents molecular deposition on the interface, ensuring that molecules continuously migrate to the droplet's edge. As evaporation progresses, this leads to significant molecular concentration, making the process highly effective for applications requiring precision and sensitivity, such as analytical chemistry, biosensing, and environmental monitoring. Unlike conventional concentration methods, this approach minimizes contamination while enhancing the detection of target molecules.

Beyond molecular enrichment, this method facilitates the separation of biological macromolecules, including DNA and proteins, from solution. Importantly, it preserves these macromolecules in their native conformations, which is crucial for studying their structure and function. By combining in-situ characterization techniques such as Raman spectroscopy, X-ray diffraction, and transmission electron microscopy (TEM), we gain detailed structural insights into these macromolecules. This enables a deeper understanding of complex biological systems and supports advancements in biochemical analysis, molecular biology, and nanotechnology.

An additional breakthrough in our research reveals that evaporating droplets not only enrich molecules but also concentrate electric charge. Even when starting with an initial charge as small as a few tens of picocoulombs (pC), the charge progressively accumulates as the droplet shrinks. This continuous charge enrichment intensifies the electric field on the droplet's surface. When the charge reaches a critical threshold, known as the Rayleigh limit, the electrostatic repulsion overcomes surface tension, leading to spontaneous droplet fission—also known as Rayleigh Fission. This marks the first reported instance of spontaneous Rayleigh Fission driven purely by charge enrichment during evaporation.

This phenomenon has significant implications for fields such as electrochemical reactions and bioreactors. The ability to manipulate charge concentration in droplets opens new possibilities for optimizing reactions at the microscale. By harnessing charge enrichment, researchers may develop innovative methodologies to control electrochemical processes, enhance reaction efficiency, and improve the performance of microfluidic systems. The potential applications extend to nanotechnology, where precise charge manipulation could play a role in advanced material synthesis and molecular assembly.

The combination of molecular and charge enrichment through droplet evaporation presents a unique and versatile platform for scientific and technological advancements. It offers a novel approach to molecular concentration, separation, and charge manipulation, with applications spanning analytical chemistry, biosensing, nanotechnology, and electrochemistry. By further exploring this phenomenon, we can unlock new capabilities in biochemical analysis, develop next-generation diagnostic tools, and refine microscale reaction control techniques. This research paves the way for innovative applications,

demonstrating how fundamental physical processes can be harnessed for practical and transformative advancements.



Short Bio: Dr. Peng ZHANG, is currently an Assistant Professor in the Department of Applied Science and Technology at the Polytechnic University of Turin, Italy.

He obtained his PhD degree in Analytical Chemistry from Kyung Hee University in the Republic of Korea in 2017, and was awarded the "Best PhD Dissertation Award" for his innovative research on non-fluorescent super-resolution microscopy techniques. After completing his doctoral studies, he worked as a Postdoctoral Researcher and a Senior

Research Scientist in the teams of Prof. Di Fabrizio and Prof. Mishra at King Abdullah University of Science and Technology (KAUST), and also held a visiting scholar position at the Swiss Federal Laboratories for Materials Science and Technology (Empa). He has accumulated systematic research experience in the fields of interfacial science, optical imaging, and materials analysis.

Since 2024, Dr. Zhang has joined the Polytechnic University of Turin, where he conducts scientific research and teaches courses. His research focuses on bioanalysis of micro-nano devices, single-molecule detection, super-resolution imaging, and interfacial molecular physicochemical processes. He has established an interdisciplinary research system integrating nanophotonics, microfluidics, and spectroscopy analysis. To date, he has published 28 SCI papers, 1 book chapter, and holds 3 patents. His research achievements have been cited over 1,300 times, with several works published in top international journals including PNAS, Communications Biology, Chemical Science, Scientific Reports, and JPC Letters.

Avoiding Decapitation Strikes: Quantum Direct Communication with Exposure Awareness

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Decapitation strikes have become one of the most important offensive tactics in modern warfare. The core of such strikes lies in tracking and precisely locating high-value targets through multi-dimensional means such as satellites, electronic surveillance, and cyber infiltration. Traditional communication systems are incapable of perceiving monitoring when a target's whereabouts have been compromised. Therefore, developing effective anti-monitoring technologies is critical to avoiding decapitation strikes. Quantum secure direct communication uses quantum states as information carriers; once subjected to monitoring, its bit error rate rises sharply, thereby alerting users to the risk of location exposure. This report introduces the principle behind exposure awareness in quantum secure direct communication, presents the current state of development of this technology, and discusses its future prospects.



Short Bio: Gui-Lu Long is a professor at Tsinghua University, and an APS Fellow and IoP fellow. He has published more than 500 academic papers and 5 monographs, and applied for or been authorized more than 60 patents. He proposed the technology of quantum secure direct communication and the LCU quantum computing paradigm. He has received the Second Class Prize of the State Natural Science Award, the IBM Global Outstanding Scholar Award. In 2025, the World Quantum Year, he was honored as one of the 《Quantum 100》 by UNESCO.

THz near-field imaging with a free-electron laser

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Intense THz fields from electron-accelerator or tabletop-laser sources provide unique experimental opportunities for exploring electronic properties in semiconductors. In this talk I will discuss two topics, (i) a semiconductor-based superlens for sub-diffraction-limited THz near-field imaging, and (ii) plasmonic nonlinearities in semiconducting GaAs/InGaAs core/shell nanowires giving rise to a redshift of the plasmon resonance.

The presented work was conducted in collaboration with D. Lang, L. Balaghi, E. Dimakis, M. Helm, R. Hübner, D. Lang, A. Pashkin, S. Winnerl (HZDR), and S.C. Kehr, L.M. Eng (TU Dresden, Germany).



Short Bio: Harald Schneider has been the head of the Spectroscopy Department at the Institute of Ion Beam Physics and Materials Research, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany, and faculty member at the University of Freiburg, Germany. His research interests include optoelectronic properties of semiconductor nanostructures and 2D materials, ultrafast and THz spectroscopy using tabletop laser systems as well as the free-electron laser at HZDR, and infrared detectors and lasers.

Integrated Silicon Photonics with Quantum Dot On-Chip Lasers

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The rapid growth of artificial intelligence, high-performance computing, and secure communication has created an urgent demand for faster and more energy-efficient hardware platforms. Silicon photonics has emerged as a powerful solution by combining the scalability of CMOS electronics with the speed of light. However, its full potential relies on one essential element — an efficient and reliable on-chip light source. In this talk, I will present our recent breakthroughs in integrating quantum dot (QD) lasers onto silicon and other photonic platforms through heterogeneous integration. These QD-based light sources exhibit record-low threshold currents, ultranarrow linewidths, and remarkable temperature and feedback stability, paving the way for scalable, CMOS-compatible optical systems. Building on this foundation, I will discuss how such integrated light sources enable a wide range of emerging applications — from photonic computing units (PCUs) for AI acceleration, to silicon photonics-integrated LiDAR for autonomous systems, and chaos-based photonic hardware for next-generation cybersecurity. By connecting materials innovation, device engineering, and system-level integration, our work aims to transform silicon photonics into a universal hardware platform — one that unites communication, computation, and sensing through light, paving the way toward an intelligent and energy-sustainable future.



Short Bio: Yating Wan is Assistant Professor of Electrical and Computer Engineering at KAUST, where she leads the Integrated Photonics Lab. Her research focuses on scalable integrated photonics, spanning semiconductor device physics, heterogeneous integration, and system co-design, with particular emphasis on quantum-dot lasers and foundry-compatible on-chip light sources. Her group develops photonic integrated systems for optical interconnects, AI acceleration, photonic security, and coherent LiDAR, and has advanced quantum-dot lasers with wide single-mode tunability, feedback tolerance, mode locking, ultra-narrow linewidth, and high-yield integration on silicon and emerging multi-material platforms. Since joining KAUST in 2022, she has built a 20-member research program, published 31 journal papers, and secured over \$3.15 million in PI-led funding. She has authored more than 100 peer-reviewed publications (38 first-author, 29 corresponding-author) in *Nature Photonics*, *Nature Electronics*, *Nature Reviews Electrical Engineering*, *Light: Science & Applications*, *Optica*, *Laser & Photonics Reviews*, etc. Her honors include the 2025 IEEE Photonics Society Young Investigator Award, the 2025 Sony Women in Technology Award with Nature, and the 2021 CLEO Tingye Li Innovation Prize. She also serves the field as Associate Editor of *IEEE Journal of Quantum Electronics*, *IEEE Photonics Journal*, and *Applied Optics*.

Towards VCSEL array-based optical neural networks

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Optical neural networks (ONNs) offer a promising route toward ultrafast and energy-efficient computing, but fully exploiting their speed advantage requires that all neural operations be performed directly in the optical domain. In this talk, I will present the recent work on Vertical-Cavity Surface-Emitting Laser (VCSEL) arrays as a high-speed platform for next-generation photonic neural architectures.

VCSELs are a mature and widely adopted technology, offering several practical advantages, including low lasing thresholds, high modulation bandwidths, efficiencies exceeding 50%, low manufacturing costs, robustness, and straightforward integration into dense arrays. These features make them particularly attractive for hardware implementations of ONNs and intelligent optical sensing systems.

The nonlinear response of simultaneously optically injected and electrically pumped VCSELs can be used to realise tunable optical neurons and network nodes. By tailoring the VCSEL structure, optical injection conditions, and electrical bias, it is possible to engineer a controllable nonlinear transfer function between injected optical power and output response, closely resembling activation functions used in artificial neural networks.



Short Bio: Krzysztof Tyszka specialises in photonic neuromorphic computing and optical neural networks based on optical microcavity systems. He is currently an Assistant Professor at the Institute of Experimental Physics, Faculty of Physics, University of Warsaw (UW). He leads research on ultrafast optical spiking neurons based on exciton-polariton microcavities and optical networks using Vertical-Cavity Surface-Emitting Lasers (VCSELs). His work focuses on developing next-generation, energy-efficient intelligent optical sensing devices inspired by biological neural systems.

He completed his doctoral studies at the Research Institute of Electronics of Shizuoka University, Hamamatsu, Japan. His PhD education was supported by the MEXT Scholarship from the Japanese Ministry of Education. As part of a double degree program, in 2015, he was jointly awarded the D.Eng. and PhD degrees in nanoelectronics from Shizuoka University and Warsaw University of Technology. Until 2018, he held a permanent position as an Assistant Professor at Warsaw University of Technology, where he was involved in R&D projects carried out in collaboration with the automotive industry. Until 2019, he also worked as a design engineer in the metrology, automation, and robotics sector.

In 2020, he received the First-Degree Rector's Award at Warsaw University of Technology for his research contributions. Since 2020, he has been affiliated with the University of Warsaw, initially as a postdoctoral researcher in the Department of Solid State Physics, and later as a research fellow at the Atomic, Molecular and Optical Science Centre. Since 2024, he has served as Principal Investigator of a scientific project funded by the Polish National Science Centre.

From Sensor Solutions to Physical AI: How the Micro_Photonic can support the new era of the AI

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Prof. Diaa Khalil

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AI tools are currently used extensively in all the levels of education, research and data handling applications. These AI tools allows robots, vehicles and all moving elements to get the necessary smartness required for autonomous and independent behavior / interaction. The new era of AI applications requires the AI agent to sense and interact based on its sensing inputs. This is the area in which micro photonics can support the robotic action and also make use of its capabilities. In this talk we will investigate how an AI-Supported MEMS based micro spectrometer can enables the Physical AI solutions in different applications including gas sensing and solid/ liquid material identification in both the IR and MIR ranges.



Short Bio: Diaa Khalil has over 40 years of experience in micro and nano photonic systems. He obtained his PhD from INPG France in 1993. He is Professor of photonics since 2004 in ASU where he was also the Chairman of the ECE Dept., the vice dean of research and the acting dean. He was also the CEO of the Innovators Support fund ISF in Egypt. He supervised more than 80 MSc and PhD. From 2007 to 2020, he was the CTO of the Optical MEMS Division in Si-Ware Systems where he is currently a Chief Innovation Officer. He is inventor of more than 30 patents and patent applications, author and co-author of more than 375 publications, 6 book chapters and 1 book. He is a member in the editorial board of the Nature journal, Light: Science and Applications, and associate editor of the IEEE-PTL journal. He is a holder of the Egyptian State appreciation prize in engineering sciences in 2021.

Toward p-type 2D semiconductors: from efficient hole doping to wafer-scale growth

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Two-dimensional (2D) semiconductors have emerged as prime candidates to extend Moore's Law, garnering significant interest from academia, industry, and the International Roadmap for Devices and Systems (IRDS). This is due to their atomic-scale thickness, high carrier mobility, and exceptional gate electrostatic control. However, pronounced electron doping, originating from interfacial charge impurities and intrinsic structural defects, has created a significant bottleneck: the prevalence of strong n-type behavior contrasts sharply with the scarcity and inferior performance of p-type characteristics.

To address this challenge, we developed a p-doping strategy for 2D semiconductors based on interfacial coupling. This approach enables universal p-type doping of n-type 2D transition metal dichalcogenides (TMDCs), facilitating the construction of CMOS logic devices and high-performance PN junction optoelectronics. By leveraging a disruptive interfacial effect, our method offers a simple, stable doping process that preserves the exceptional intrinsic properties of the 2D semiconductors. Furthermore, we established a method for the controlled growth of wafer-scale films of a novel 2D material, monolayer MA2Z4. We investigated its unique nonlinear optical properties and demonstrated effective modulation of its doping concentration and electrical performance through compositional tuning. Leveraging this material, we subsequently fabricated high-performance p-type field-effect transistors and CMOS logic devices. [1]

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Short Bio: Dr. Mengjian Zhu is a professor in Nanoscience and Optical Engineering at the National University of Defense Technology. Dr. Mengjian Zhu's research interests include electronic properties and light-matter interaction in graphene, 2D materials and their van der Waals heterostructures. He is also interested in optical spectroscopy of van der Waals quantum materials. He and his group have published more than 10 Nature series journal papers, including 2 Nature Physics, 2 Light: Science & Applications, and 6 Nature Communications, with a total citation > 4000 and a h-index of 32.

Heterogeneous integrated optical modulators and photodetectors for communication and computing

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Heterogeneous integrated optical modulators and photodetectors can meet the requirements of super large capacity and super high-speed information systems and data centers. In this regard, we demonstrated (1) a microscale graphene thermo-optic modulator with a compact area of $7.54 \mu\text{m}^2$ and high heating performance of up to $67.4 \text{ K } \mu\text{m}^3 \cdot \text{mW}^{-1}$; (2) a graphene electro-absorption modulator with a high modulation efficiency up to 5.3 dB/V and a high-speed data transmission rate up to 56 Gb/s; (3) a graphene modulator for activation functions in optical neural networks; (4) a graphene photodetector for visible light communications; (5) a BTO MZI modulator enabled by polymer-assist transfer technique with a modulation efficiency of 1.67 Vcm; (6) a PTO modulator by the same technique with a modulation efficiency of 300 pm/V.



Short Bio: Junjia Wang received the B.Asc. degree in electrical and computer engineering from University of Toronto in 2009, and the M.Eng. and Ph.D. degrees from McGill University in 2012 and 2016. He was with Optoelectronics Research Centre at University of Southampton from mid 2015 to end of 2016 under the Photonic HyperHighway project as a Research Fellow. Then he joined University of Cambridge and was working on Graphene Flagship project. He is now a professor with the School of Integrated Circuits at Southeast University. He is IEEE senior member, Shuangchuang Talent of Jiangsu and Purple Scholar. His research interests are in heterogeneous integrated photonics.

Track 4: Micro-and Nano-Photonics

Metasurfaces for manipulating vectorial light fields

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Metasurfaces are ultra-thin metamaterials composed by artificial planar meta-atoms arranged in some specific macroscopic orders, which exhibit extraordinary capabilities to control electromagnetic waves [1]. Recently, much attention has been devoted to employing carefully designed metasurfaces to generate and control vectorial light beams, which exhibit not only non-trivial wavefronts but also freely tailored polarization distributions [2]. In this talk, I will introduce our latest results on designing metasurfaces for generating and controlling vectorial light fields in reflection and transmission configurations, based on propagating-light excitation and surface-wave excitations, respectively [3-5].

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Short Bio: Lei Zhou received his PhD in Physics from Fudan University, Shanghai, China, in 1997. He then went to Institute for Material Research in Tohoku University (Sendai, Japan) for postdoctoral research. In 2000 - 2004, he was a visiting scholar in Physics Department of the Hong Kong University of Science and Technology. He joined Physics Department of Fudan University in 2004, served as Chair of Physics Department in 2020-2024, and is now vice president of Fudan University. He got the NSFC "Grant for Outstanding Young Scientist" in 2007 and was entitled "Chang Jiang Scholars Program" Chair Professor in 2009. He is an elected Fellow of OPTICA, APS and COS, and a funding co-editor-in-chief of *Photonics Insights* and *Optics and Photonics Research*.

qRICO-Net: machine-learning-based crystallographic orientation mapping using polarized Raman microscopy

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Quantitative Raman Imaging for Crystal Orientation analysis (qRICO) is capable of performing fast, simple orientation mapping of materials using polarized Raman microscopy and image reconstruction [1]. It is a non-destructive, cost-effective, and fast characterization technique for 2D and 3D orientation mapping of polycrystalline materials with no sample preparation requirements. The basic idea involves the simultaneous measurement of Raman scattering at different polarization setups (16 polarization channels).

qRICO requires knowledge of the Raman tensor elements and, for optically anisotropic systems, measurement of the corresponding Jones matrices, resulting in more complex analytical expressions [2]. qRICO-Net is a way to face these challenges indirectly using data-driven approach. Polarized Raman measurements were correlated with crystallographic orientation maps obtained by EBSD, which served as ground truth for training. qRICO-Net takes a per-pixel spectra and applies 2D convolutions over polarization and wavenumber to extract a spectral feature embedding. The features are globally pooled and passed through residual MLP blocks to regress a 6D rotation representation, which is converted into an SO(3) rotation matrix for symmetry-aware misorientation loss. This design separates spectral feature learning from physically consistent orientation regression. The model was tested using Sb_2S_3 samples (Fig. 1). Sb_2S_3 is a quasi-1D solar absorber whose solar cell performance strongly depends on crystallographic orientation, where grains oriented close to the [hk1] direction promote favorable charge-transport pathways and reduce recombination losses. The orientations predicted with qRICO-Net (Fig. 1E) are in good agreement with EBSD results (Fig. 1F) with an average misorientation angle of 9 degrees. A successful data-driven qRICO could become the key orientation mapping tool for various functional, polycrystalline thin films in optoelectronic devices, and enable systematic optimization of the absorber microstructure to improve solar-cell efficiency.

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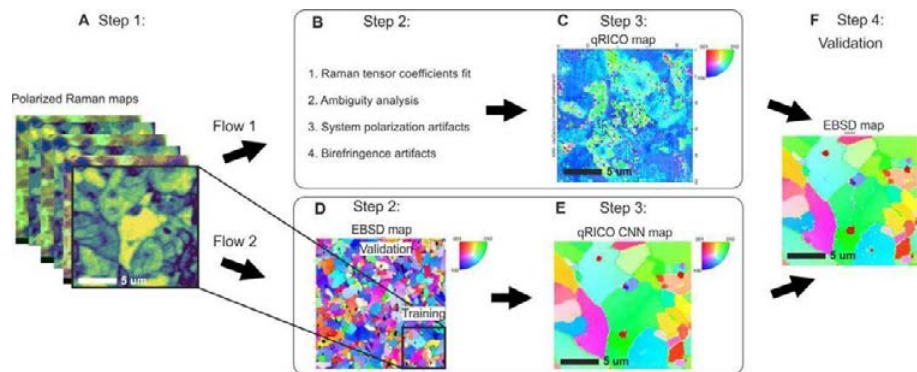


Figure 1: (A) qRICO maps of Sb_2S_3 films, (B) illustration of analytical steps that must be conducted, (C) orientation map obtained by qRICO of the same area as shown on Fig. 1F. The colors refer to the orientations as defined by the inverse pole figure (top right), (D) EBSD map used for training and validation, (E) orientation map obtained by qRICO-Net, (F) orientation map obtained by EBSD.



Short Bio: Oleksii Ilchenko received his PhD degree in Optics and Laser Physics from Taras Shevchenko National University of Kyiv, Ukraine. He is a CEO of Lightnovo ApS, Denmark – company that develops and produce Raman spectrometers and Raman microscopes.

Narwhal wavefunctions and the quest for ultimate light localization

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How far can light be localized while remaining a low-loss optical eigenmode? This question lies at the heart of nanophotonics, cavity quantum electrodynamics, and strong light–matter interaction. Dielectric cavities store photons with low loss but are constrained by diffraction, whereas plasmonic structures beat diffraction at the cost of dissipation. Narwhal wavefunctions offer a route beyond this trade-off. Emerging from a singular dispersion equation, they combine a power-law singular core with an exponentially decaying tail in a single dielectric eigenstate. This field structure concentrates optical energy towards nanometre and atomic length scales while preserving long photon storage. This talk will discuss how narwhal wavefunctions enable extreme light localization, strong vacuum fields, and enhanced light–matter interaction, opening a route to quantum nanophotonics at fundamental length scales.



Short Bio: Ren-Min Ma received his PhD degree in Condensed Matter Physics from Peking University. He is a professor of Peking University, China.

Shed Light on chirality and carrier spin dynamics of metal halide perovskite quantum dots and nanoclusters

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Spin dependent charge carrier dynamics is of strong interest in gaining fundamental understanding of how charge carriers interact with phonons, defects and surface in solid state materials including nanomaterials such as quantum dots (QDs) and nanoclusters. In our effort to understand exciton and charge carrier dynamics in semiconductor nanostructures, we have recently focused on using ultrafast laser spectroscopy with controlled polarization of the pump and probe beams to interrogate the spin-dependent dynamics of charge carriers in metal halide perovskite QDs (PQDs) and nanoclusters (PNCs) and found a strong dependence on particle size and surface properties. Comparison between CsPbBr₃ and CH₃NH₃PbBr₃ PQDs reveals interesting difference in their carrier spin dynamics due to difference in local symmetry caused by the A component. The results indicate that both size and surface defects play a critical role in the spin lifetime of charge carriers in such nanostructures besides composition. Additionally, we found that nuclear spin has a strong effect on the electron spin lifetime based on isotope enrichment studies. Furthermore, we have found that intrinsically chiral PQDs and PNCs can be generated from achiral reactants due to interfacial symmetry breaking that leads to unequal enantiomer populations. Our preliminary data show dependence of spin dynamics in chirality of the PQDs. The results provide important guidelines in designing materials with desired spin and chiral properties for emerging applications such as spintronics and opto-spintronics.



Short Bio: Jin Zhong Zhang received his PhD degree in Physical Chemistry from University of Washington Seattle. He is a distinguished professor of University of California Santa Cruz USA.

Theory and applications of complex-frequency excitations in photonics

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Complex-frequency excitations have recently attracted a lot of attention owing to their ability to solve a number of extraordinary challenges in photonics, such as overcoming losses without gain in metalenses and plasmonic waveguides and achieving virtual absorption. However, the totality of the works so far has been mainly computational or experimental, and a full theory of the complex dynamics enabled by these excitations is still missing. We shall present a fully analytical, exact time-domain theory for the dynamical scattering of these excitations by both sides of dielectric plates, which has been used to achieve virtual absorption. Our precise theoretical analysis confirms previous observations and, in addition, reveals a number of intriguing phenomena that were previously missed, such as discontinuities in the scattering of the outgoing electromagnetic field and release of the stored energy in distinct packets.



Short Bio: Kosmas L. Tsakmakidis is an elected Associate Professor in the Department of Physics of the National and Kapodistrian University of Athens (NKUA), Greece. He is one of the early young pioneers in the field of metamaterials. He obtained his Diploma degree in Electrical & Computer Engineering from the Aristotle University of Thessaloniki, Greece (2002), his Master of Research (MRes) *summa cum laude* in Electronic Engineering from the top-ranked Advanced Technology Institute (ATI) of the University of Surrey, UK (2003), and his Doctorate degree (PhD) in Applied Physics and Engineering from ATI, University of Surrey (2009). He has worked as a postdoctoral researcher at Imperial College London (UK), UC Berkeley (USA), University of Ottawa (Canada), and EPFL (Switzerland).

OLEDs with Record Light Output for Communications and an Electrically Driven Polymer Laser

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Organic light-emitting diodes (OLEDs) have been successfully developed for displays. They are often thought to be slow and to have limited brightness. However, we show that by considering the processes limiting their response time, very fast and bright OLEDs can be made. We show that this enables high speed communication. Our fast and bright OLEDs have also enabled us to address the long-standing problem of making an electrically driven organic laser. By integrating an OLED with record brightness with a polymer distributed feedback laser, we have made the first electrically driven polymer laser.



Short Bio: Ifor Samuel is Professor of Physics at the University of St Andrews. He received his MA and PhD from the University of Cambridge, working on optical spectroscopy of organic semiconductors. He was a Research Fellow at Christ's College, Cambridge and also performed postdoctoral work at CNET-France Telecom in Paris, before setting up his own research group on light-emitting polymers at the University of Durham. In 2000 he moved to the University of St Andrews where he founded and leads the Organic Semiconductor Centre. His current work concerns the photophysics of organic semiconductor materials and devices, and their applications in communications and medicine.

Colloidal nanoplasmonics to enhance light-matter interaction in nanophotonic devices

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We consider the basic phenomena affecting light-matter interaction for a quantum system in presence of a metal nanobody and discuss the existing and promising applications in the following devices: Raman sensors, fluorescent sensors/converters, electroluminescent structures, photovoltaic cells, photodetectors, and optical limiters. The photonic nanotranceiver conception is proposed for an emitter coupled to a metal nanobody. Enhanced photostability and inhibited photochemistry are highlighted, and prospective application of fast nanoemitters owing to plasmonic effects are discussed for Li-Fi systems and integrated photonic circuits. Faced to multiple parameters involved and the relevant multi-dimensional space in every nanoplasmonic problem the need for deep learning approach is outlined and its first implementations are presented.



Short Bio: Sergey V. Gaponenko is the B.I. Stepanov Institute of Physics of the National Academy of Sciences of Belarus director. He works in the field of nanophotonics and has more than 200 peer-reviewed journal papers published as well as the books (Introduction to Nanophotonics, Cambridge 2018; Applied Nanophotonics, Cambridge 2018, Beijing 2023). Among other results he suggested the consistent consideration of plasmonic effects in nanostructures to enhance performance of photonic devices.

Wireless THz single-polarization high-speed P2P and P2MP transmission over long and short distances

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Broadband wireless transmission with photonically generated THz carriers at frequencies of about 0.3 THz can complement fibre-based solutions when cost and ease of installation is an issue, especially for a dense urban deployment. Emerging applications include the connection of baseband units (BBU) and remote radio heads (RRH) for realizing a mobile fronthaul, or a point-to-point (P2P) transmission for emergency bridging an existing fibre, and use cases also comprise high-speed point-to-multipoint (P2MP) broadcast in a lecture hall or in a football arena. In this talk we present a 110 m long P2P link with a data rate of 115 Gbit/s using a carrier frequency of 0.3 THz. Despite the coherent 16QAM transmission, the analogue hardware of the Kramers-Kronig receiver simply detects intensity with a Schottky barrier diode. The hardware remains uncomplicated because all complexity is shifted to digital signal processing as it is done in present-day smart phones. We further report on a lecture-hall P2MP experiment with a frequency-steered leaky-wave antenna, where we transmit with 16QAM signaling a total of 80 Gbit/s over 16 m to a maximum number of four simultaneous users. In this case, a monolithic microwave integrated circuit (MMIC) serves as the IQ receiver, operating in the frequency range 0.280 THz...0.320 THz.



Short Bio: Wolfgang Freude is a Professor with the Institute of Photonics and Quantum Electronics and Distinguished Senior Fellow with the Karlsruhe Institute of Technology (KIT). He has (co-)authored more than 340 publications, coauthored a book entitled Optical Communications (in German), and authored or coauthored eight book chapters. His research interests include the area of optical and wireless high-data rate transmission and high-density integrated-optics with a focus on silicon photonics. He is an Honorary Doctor with Kharkov National University of Radioelectronics (Ukraine), a Member of VDE/ITG and OPTICA, and a Life Senior Member, IEEE.

Valley-Engineered Landau Polaritons in a Van der Waals Semiconductor Microcavity

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The integration of correlated quantum materials with optical microcavities offers a promising route toward engineering hybrid light–matter states with emergent many-body properties. In this work, we report the realization of Landau polaritons in a monolayer tungsten diselenide (WSe_2) embedded within a high-quality optical microcavity. By introducing a tunable two-dimensional electron gas and applying a perpendicular magnetic field, we achieve strong coupling between cavity photons and multiple interband Landau level transitions, forming hybrid quasiparticles with mixed photonic and electronic character.

These Landau polaritons exhibit pronounced valley-dependent behavior, including oscillations in resonance energies and coupling strengths governed by the integer filling of valley-resolved Landau levels. We further observe nonlinear modifications to both transition energies and coupling strengths arising from intervalley electronic correlations, highlighting the role of many-body interactions in the coupled system. The ability to control polariton properties via electrical doping, magnetic field, and valley degree of freedom establishes a versatile platform for cavity quantum electrodynamics in two-dimensional materials.



Short Bio: Long Zhang received his PhD degree in Optics from Fudan University. He is a professor of Xiamen University, China. Long Zhang's research centers on the discovery and control of novel classical and quantum state with matter-light couplings. Current topics focus on light-matter interactions in van der Waals materials based on 2D materials subjected to artificially engineered electromagnetic environment, and applications of these systems to new photonic technologies and quantum information science.

Discovery of phonon-polaritonic skyrmions

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We introduce the concept of phonon-polaritonic skyrmions in thin SiC films, which are known for their extreme k-tuning over a narrow excitation wavelength range due to its strong dispersion within the Reststrahlen band. We utilize the strong sublinear dispersion of SiC to measure and characterize the transition from bubble- to Néel-type skyrmions through minute changes in excitation wavelength.



Short Bio: Harald Giessen graduated from Kaiserslautern University with a diploma in Physics and obtained his M.S. and Ph.D. in Optical Sciences from the University of Arizona in 1995 as J.W. Fulbright scholar. After a postdoc at the Max Planck Institute for Solid State Research in Stuttgart he moved to Marburg as assistant professor. From 2001-2004, he was associate professor at the University of Bonn. Since 2005, he is full professor and holds the Chair for Ultrafast Nanooptics in the Department of Physics at the University of Stuttgart. He is also co-chair of the Stuttgart Center of Photonics Engineering, SCoPE.

Training of Free-space Optical Visual Processors

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Optical neural networks are emerging as powerful machine learning and information processing tools because of their potential advantages in speed and energy efficiency. The training methods of these physical models, however, remain underexplored compared to their digital counterparts and are leading to suboptimal performances. Here we report a transfer-learning approach that leads to snapshot image denoising with unprecedented quality. We demonstrated effective free-space optical denoising by a diffractive network optimized by a two-step process including (1) pre-training using a massive dataset of 3.45 million diverse but simple images and (2) fine-tuning with the corresponding task-specific datasets. Compared to conventional Fourier-domain filtering and directly trained diffractive networks, such transfer learning process exhibited prominent advantages for denoising images degraded with heavy noises (signal-to-noise ratio <10 dB), retaining fine features of original images while improving the signal-to-noise ratio to ~20 dB). Importantly, the same pre-trained optical network could be universally fine-tuned to process degraded images from highly diverse styles ranging from handwritten digits to CIFAR-10 images and human faces (CelebA).



Short Bio: Jingtian Hu received his undergraduate degree in Materials Science and Engineering from University of Illinois at Urbana-Champaign in 2013. He conducted his Ph. D. study in Materials Science and Engineering at Northwestern University under the supervision of Prof. Teri W. Odom and received his Ph.D. degree in 2019. Then, he worked as a postdoctoral researcher at Northwestern University from 2019 to 2021 and at University of California, Los Angeles from 2021 to 2023. Jingtian joined Harbin Institute of Technology (Shenzhen) in June 2023. His research focuses on developing photonic neural networks at the intersection of deep learning, photonics, and materials science.

Carrier Dynamics in Superlattice Material System

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Ultrafast spectroscopy is an important technical means for characterizing processes such as carrier generation, transport, and recombination, and has a wide range of applications in chemistry, physics, materials, information, and other fields. In recent years, we have been committed to developing transient and steady-state spectroscopic measurement systems with spatial, temporal, and momentum resolution capabilities, studying the physical properties of charge carriers in semiconductor material related systems, and laying an important research foundation for a deeper understanding of the optoelectronic properties of semiconductor materials and performance optimization of related devices. In this report, we mainly report some progress in the research direction of carrier migration, electron phonon coupling, and surface interface induced spectral characteristics of semiconductor materials based on micro area ultrafast spectroscopy.



Short Bio: Xinfeng Liu, Hundred Talents Program of the Chinese Academy of Sciences, and Deputy Director of Science and Technology, National Center for Nanoscience and Technology of China (NCNST). He obtained the doctoral degree from the National Nanoscience Center in 2011, and engaged in postdoctoral research at Nanyang Technological University (NTU) in Singapore from 2011 to 2015. In 2015, he joined NCNST through the Overseas Talent Program of the Chinese Academy of Sciences. In 2023, he was supported by the Outstanding Youth Program of the National Science Foundation of China. His current research interests mainly focus on the study of high spatial and temporal resolution ultrafast dynamics and related physical and chemical properties.

Field-enhanced nonlinear optics of low-dimensional and interfacial systems

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Nonlinear optics plays a vital role in laser physics, optoelectronic devices, and advanced material characterization, particularly for low-dimensional and interfacial systems. However, its applications are often limited by weak nonlinear polarizability, requiring field enhancement to unlock full potential. Recently, we developed diverse enhancement strategies using micro/nanophotonic structures and optical metasurfaces for various systems, including electrochemical interfaces, oxide-water interfaces, and low-dimensional/organic molecule interfaces. These approaches successfully extended nonlinear spectroscopy to previously challenging materials, significantly boosting interfacial nonlinear optical responses and revealing novel effects such as exciton-vibration coupling enhancement, laying groundwork for further methodological advances.



Short Bio: Weitao Liu received her PhD from UC Berkeley. She is the Xie Xide Young Chair Professor at Fudan University. Her research focuses on interfacial nonlinear optics and in-situ spectroscopy, developing field-enhancement and low-wavenumber sum-frequency techniques to characterize buried interfaces, correlated oxides, and quantum materials. As corresponding author, she has published in *Light:Science&Applications*, *Nature Photonics*, and *Nature Nanotechnology*, etc. She leads NSFC original exploration and other major research programs, received the First Prize of Shanghai Natural Science Award (2025, 2nd awardee), and was selected for the National Excellent Young Scientists Fund.

Shining wrinkles: making graphene emissive at room-temperature

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Landau emission, i.e. the spontaneous radiative decay of electrons between quantized Landau levels, holds great promise for compact, tunable light sources spanning the infrared to terahertz regimes. Yet its experimental realization has remained exceptionally elusive. In conventional semiconductors, Landau emission demands both cryogenic operation and colossal external magnetic fields, and is universally quenched by ultrafast non-radiative Auger recombination. In this talk, I will show how controlled deformations in graphene can induce giant pseudomagnetic fields to quantize the electronic states into Landau levels with large energy spacings. By controlling the Landau quantization, we have effectively suppressed non-radiative Auger recombination and successfully achieved spontaneous emission from macroscopic graphene samples under continuous-wave excitation. Our work establishes a new paradigm for steering light–matter interactions in quantum materials and paves a practical route toward room-temperature Landau-level lasers, broadband absorbers, and advanced optoelectronic devices.



Short Bio: Yu Luo received his Ph.D. in Physics from Imperial College London in 2012. He served as a faculty member at Nanyang Technological University, Singapore, from 2015 to 2023, where he was also Deputy Director of the Opto-Electronic and Bio-Photonics Centre.

Professor Luo's interdisciplinary research spans electromagnetic metamaterials, surface plasmons, nanophotonics, transformation optics, and topological photonics. His work develops novel metamaterial-based mechanisms for signal generation, transmission, processing, control, and measurement. By overcoming key limitations of conventional microwave photonic technologies—bandwidth constraints, energy loss, electromagnetic interference, and multi-channel transmission challenges—his research enables innovative applications in aviation, aerospace, and defense. These advances provide foundational support for breakthroughs in radar systems, space-ground integrated networks, avionics architectures, and deep-space exploration missions.

Single-photon sources based on quantum dots in photonic crystal cavities

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Single-photon sources are key building blocks for photonic quantum information technologies. Semiconductor quantum dots provide deterministic single-photon emission with high purity and indistinguishability, while photonic microcavities offer an effective route to enhance emission and tailor photon properties. In this talk, I will present our recent progress in quantum-dot single-photon sources based on photonic crystal cavities. First, I will introduce a moiré photonic crystal cavity for flatband cavity quantum electrodynamics. Owing to its high photonic density of states, the moiré cavity enables strong Purcell enhancement over an enlarged spatial region, relaxing the stringent requirement for precise quantum-dot positioning. Second, I will discuss a nonlocal photonic-crystal metasurface that combines quasi-bound-state-in-the-continuum physics with geometric-phase wavefront engineering. By directly embedding quantum dots inside a GaAs metasurface, the device integrates cavity-enhanced light-matter interaction and wavefront shaping in a single photonic structure, enabling structured single-photon emission such as orbital-angular-momentum beams and holographic patterns. These results show that photonic crystal cavities can improve both the performance and functionality of quantum-dot single-photon sources, providing a promising route toward scalable and multifunctional quantum photonic devices.



Short Bio: Feng Liu is from the College of information science and electronics engineering, Zhejiang University. His research activities are focused on quantum light sources based on III-V quantum dots and cavity-quantum electrodynamics.

Wavefront Control with Metasurfaces for Optical Interconnects

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Dielectric metasurfaces provide a powerful platform for manipulating the wavefront and polarization of light with subwavelength spatial resolution, offering a promising route toward compact, scalable components for high-density optical interconnects. However, achieving high optical efficiency remains a central challenge and often demands advanced inverse-design approaches. In this talk, I will present our recent progress in using dielectric metasurfaces to realize devices for high-density optical interconnects, with an emphasis on design strategies for improving device efficiency.



Short Bio: Paulo Dainese is a Senior Principal Scientist in the Optical Physics Department at Corning Research & Development Corporation. His research focuses on the interaction of light and matter, with expertise in areas such as nonlinear optics, metamaterials, and optical fibers. He earned his Ph.D. in Physics from the Gleb Wataghin Physics Institute at the University of Campinas (Unicamp, Brazil).

Continuous-Wave Chiral Exciton–Polariton Lasers Across the Visible and Infrared

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Generating circularly polarized coherent light is essential for next-generation spin-photonics and quantum information processing. However, realizing compact, intrinsically chiral lasers remains a challenge. We exploit strong light-matter coupling between chiral excitons and cavity photons to realize continuous-wave (CW) chiral exciton-polariton lasing spanning both the visible and infrared spectral ranges. We first demonstrate room-temperature CW circularly polarized lasing from a chiral 2D perovskite, $(\text{MBA})_2\text{PbI}_4$, where hybrid exciton-polaritons exhibit an ultralow threshold of $0.5 \text{ W}\cdot\text{cm}^{-2}$ and intrinsic circular polarization with a photoluminescence dissymmetry factor of 0.30. The lasing wavelength is tunable via cavity thickness, and the device maintains $>95\%$ of its output intensity under prolonged CW operation, showing exceptional material and optical stability. Building on this platform, we extend the concept to the infrared regime by developing chiral quasi-2D perovskite heterostructures designed through tailored organic cations and spacer layers that enhance excitonic coherence and chiroptical coupling. These engineered materials enable spin-polarized exciton-polariton condensation in the near-infrared, marking the first realization of infrared chiral polariton lasing at room temperature. Together, these results establish a versatile photonic platform for CW, spin-polarized exciton-polariton lasing across broad spectral ranges. Beyond demonstrating record-low thresholds and high polarization purity, this work provides insights into chirality under strong coupling and paves the way toward spin-polarized quantum fluids of light and next-generation perovskite-based spintronics and photonic technologies.



Short Bio: Siying Peng received her PhD degree in Physics from California Institute of Technology. She is an assistant professor at Westlake University, China.

Optical skyrmions in single microcavities formed by photonic spin-orbit coupling

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Fabry-Perot (FP) microcavities with metal or DBR (distributed Bragg reflector)-coated mirrors provide an excellent platform for investigating the collective behavior of confined 2-dimensional photons and polaritons. The TE-TM mode splitting in such cavities acts as an effective magnetic field, leading to photonic spin-orbit (SO) coupling effect that the pseudospin of cavity photons changes anisotropically with their momenta. Such mechanism has led to interesting observations including optical spin-Hall effect, magnetic-monopole-like half solitons, spinor condensate with half-quantum circulation, and polaritonic topological insulators. In recent years, we report the direct measurement of the Berry curvature and quantum metric in anisotropic organic microcavities, which leads to divergent quantum metric at Voigt exceptional points and dual lasing of orthogonal polarization by polariton relaxation via the imaginary Fermi Arics.

Furthermore, by analyzing the photonic SO coupling mechanism with the perturbation theory of Hamiltonians, we predict that in fully confined systems the eigenstates of the second excited manifold under TE-TM splitting are degenerate skyrmions which can be selected and manipulated by the non-Hermitian properties. This theory was experimentally demonstrated by coupling the microcavity with a single quantum dot. We further explore how the evolution of the skyrmions wavefunction with non-Hermitian gain and loss, highlighting the special properties at the exceptional points.



Short Bio: Feng Li received his PhD degree in Physics from University of Nice Sophia-Antipolis (& CNRS-CRHEA), France. He is a professor of Xi'an Jiaotong University, China.

Research on Shear Phonon Polaritons in CdWO₄

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Hyperbolic shear phonon polaritons exhibit asymmetric propagation characteristics and frequency-dependent optical axis rotation phenomena. However, there is still a lack of an intrinsic method that can controllably change these shear properties without the need for external structural design. Here, we demonstrate that surface orientation engineering provides an intrinsic approach for tailoring shear phonon polaritons in monoclinic crystals. Using CdWO₄ as a platform, we show that changing the orientation of the excitation plane reconfigures the planar projection of the non-orthogonal infrared-active phonon dipoles, thereby directly reshaping the dielectric tensor within the plane. Through the combination of synchrotron-based Otto-ATR spectroscopy, we determined two different phenomena controlled by surface orientation. Firstly, the shear properties of hyperbolic phonon polaritons are changed. Secondly, surface orientation engineering triggers a topological transition, from a hyperbolic-lenticular-like distribution to a pure elliptical contour. Our research results indicate that surface orientation engineering can serve as a predictive design principle to regulate the phonon polariton properties in low-symmetry crystals and has wide applicability for other monoclinic systems.



Short Bio: Yue Liu is a first-year PhD student focusing on phonon polariton physics and applications.

Harnessing highly efficient coherent polariton parametric emission in quantum confined microcavities

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Microcavity exciton polaritons emerge as a versatile platform for nonlinear optical effects thanks to the unique dispersion enables a manifold of energy and wavevector conserved processes. However, efficient generation of parametric emission while preserving coherence remains challenging mainly due to lack of strong parametric interactions compared to simultaneous interaction with relaxation channels. Herein, we report highly efficient parametric emission with sub-1 meV linewidth from quantum confined microcavities, enabling the first observation of strong phase coherence between the two parametric species. Quantum size effect enabled by surface disorder in confined systems acts as the microscopic mechanism for the observed anomalous enhancement of parametric emission, playing important role in triggering exotic parametric interactions for microcavity polaritons. Finally, we demonstrate the emergence of polariton supersolid phase at room temperature in a coherent parametric oscillator, characterized by periodic density modulation in real space that indicates the breaking of translational symmetry.



Short Bio: Qing Zhang is an tenured Associate Professor from Peking University, China. She is National High-level Young Talent, Beijing Outstanding Young Scientist, and Principal Investigator of Key R&D Program Project and NSFC Joint Fund Key Project. She received her bachelor's degree from USTC in 2005, and her Ph.D. in Physics from THU in 2010. From 2011 to 2016, she conducted postdoctoral research at NTU, Singapore. She began her independent academic career at Peking University in 2016. Her research focuses on light-matter interactions in optoelectronic materials at the nanoscale and their applications in nanophotonics and optoelectronic devices.

Light-matter interactions in photonic nanostructures and magnetic nanomaterials

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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 recent research advances. By constructing nanoscale artificial metamaterials, we successfully realized Majorana zero mode on photonic and electromechanical chips, achieving single-mode large-area characteristics for III-V semiconductor lasers and MEMS resonators. By exploring novel magnetic quantum materials, we have achieved 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.



Short Bio: Jingwen Ma is an Associate Professor at the Southern University of Science and Technology, China. 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.

Structured Lasing with Topological and Moiré Photonic Cavities

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Miniaturized lasers play a key role in applications ranging from display technologies to biological sensing to quantum optics. However, due to geometric and symmetry constraints, conventional laser cavities offer limited design freedom for realizing complex polarization textures and steerable emission directions. This talk describes how advanced photonic design approaches, including Dirac-vortex cavities and moiré photonic superlattices, can enable desired emission properties from compact lasers. I will first show that plasmonic Dirac-vortex cavity design via three-dimensional photonic mass vortex engineering can realize engineered lasing emission with topological protection. Next, I will show how a combination of perovskite nanocrystals with gradient moiré nanostructures can facilitate wide-range laser beam steering. Finally, I will discuss how twisted moiré bilayer coupling can produce vector vortex beams from symmetry-protected bound states in the continuum and linearly polarized beams from symmetry-broken radiative modes simultaneously along distinct spatial channels.



Short Bio: Jun Guan is an assistant professor at The Chinese University of Hong Kong (Shenzhen). She obtained her B.S. degree in physics from Sichuan University and her Ph.D. degree in applied physics from Northwestern University. Before joining CUHK(Shenzhen), she worked as a postdoctoral scholar at the Massachusetts Institute of Technology. Jun Guan's research focuses on the design of hybrid photonic architectures

to manipulate light-matter interactions at the nanoscale and to enable laser devices with diverse functionalities. She has published papers as first author or corresponding author in journals such as Nature Nanotechnology, Nature Communications, Science Advances, Chemical Reviews, Advanced Materials, ACS Nano, and Nano Letters.

Optical Metasurface Empowered Imaging and Displaying

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Optical metasurfaces—planar arrays of subwavelength electromagnetic structures—can emulate the functionalities of bulky conventional optical components with an ultrathin form factor, and have emerged as promising platforms for advanced imaging and displaying applications. In this talk, I will present our recent work on metasurface-empowered multifunctional imaging and displaying systems. I will first introduce our efforts on implementing all-optical differentiators using dielectric metalenses, which perform spin-multiplexed arbitrary-order differential operations directly over the light field of the imaging scene. I will then discuss our recent investigations of waveguide-based metaholograms, which exploit the versatile light-field manipulation capability of metasurfaces to realize multifunctional holographic displays.



Short 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>). He has published 67 research papers with more than 7,600 citations and an H-index of 45, and delivered over 50 invited talks at international conferences.

Track 5: Intelligent Light-Field Detection

Bioinspired In-Sensor Computing for Artificial Vision

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The demand for accurate perception of the physical world leads to a dramatic increase in sensory nodes. However, the transmission of massive and unstructured sensory data from sensors to computing units poses great challenges in terms of power-efficiency, transmission bandwidth, data storage, time latency, and security. To efficiently process massive sensory data, it is crucial to achieve data compression and structuring at the sensory terminals. In-sensor computing integrates perception, memory, and processing functions within sensors, enabling sensory terminals to perform data compression and data structuring. We will overview optoelectronic intelligence for bioinspired in-sensor computing in artificial vision. We will examine optoelectronic devices that can compress and structure multidimensional vision information, and demonstrate a few vision sensors for different scenarios, including visual adaptation, motion perception, as well as event-driven vision sensors for spiking neural network.



Short Bio: Yang Chai is the Chair Professor of Semiconductor Physics of the Hong Kong Polytechnic University. He is an IEEE Distinguished Lecturer, an IEEE Fellow, an Optica Fellow, IOP Fellow, and AAIA Fellow. He is the Director of Research Institute for Artificial Intelligence of Things, the Director of Joint Research Center of Microelectronics, and the Associate Dean of Faculty of Science (Research) at the Hong Kong Polytechnic University.

He is also the Chair of Semiconductor Nanotechnology Alliance, the Vice President of the Physical Society of Hong Kong, and an Associate Editor of ACS Nano. He is a receipt of the Falling Walls Science Breakthroughs in Engineering and Technology for his work on “Breaking the Wall of Efficient Sensory AI Systems”, the BOCHK Science and Technology Innovation Prize in the field of AI and Robotics, The Croucher Senior Fellowship, The Ho Leung Ho Lee Foundation Science and Technology Innovation Award, and NSFC Distinguished Scholar. His current research interest mainly focuses on emerging electronic devices.

Integrated Photonics for Intelligent light Computing

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As demand for computing power driven by large generative models grows exponentially, intelligent optical computing has emerged as a compelling path beyond the limits of conventional electronics, leveraging its inherent advantages of ultra-high bandwidth, low latency, and energy efficiency. Alongside our work in on-chip computational spectrometers—where resonant cavity architectures enable compact, high-performance spectral sensing—we are advancing the broader frontier of photonic intelligence through other core innovations. First, we introduce a direct tensor processing architecture using coherent light, overcoming the rigid dimensionality constraints of conventional matrix computing. Second, we develop a spiking spatio-temporal optical computing scheme with nonlinear fusion, addressing the critical gap in nonlinear intelligent representation for optical systems. Together, these advances aim to establish a high-performance intelligent photonic computing foundation—one capable of delivering robust, scalable, and energy-efficient physical support for large-scale AI inference and edge computing workloads. This integrated vision, spanning sensing to computing, positions photonics as a unifying platform for next-generation intelligent systems.



Short Bio: Xuhan Guo received the B.S. degree from the Huazhong University of Science and Technology, China in 2009 and the Ph.D. degree from the University of Cambridge, UK, in 2014, then worked as a Research Associate in University of Cambridge until 2017. He joined Shanghai Jiao Tong University, China in 2017, where he is currently a full professor leading the Advanced Photonics and Optoelectronic Systems (APOS) Lab. His research interests include silicon photonics and optoelectronic systems for optical computing, sensing and data transmission. He has over 50 publications in international journals including *Nature Photonics*, *eLight*, *Nature Communications*, *Light: Science and Applications*, *Optica*, etc., and gave more than 30 invited talks at conferences including OFC, APC, IPC, etc. Prof. Guo currently serves as an associate editor of *APL photonics* and *IEEE Journal of Quantum Electronics*. He is the technical co-chair of ACP 2022 and workshop co-chair of OECC 2023, and a TPC member of international conferences including ECOC, CLEO-PR, ACP, etc.

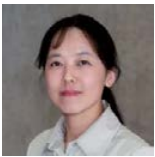
Differentiable Imaging

The University of Hong Kong, China

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Computational imaging systems increasingly rely on numerical simulation to co-design hardware and reconstruction algorithms—yet deployed systems routinely fail because real physics deviates from its idealized model. Differentiable Imaging solves this sim-to-real gap by making the entire measurement pipeline, from physical light propagation to algorithmic inference, all differentiable and calibratable against measured data. Here we discuss how this transforms numerical simulation from a design tool into a deployment bridge, enabling optical systems to approach physical information limits in real-world conditions.



Short Bio: Ni Chen is an Honorary Associate Professor of Electrical and Electronic Engineering at The University of Hong Kong. She received her Ph.D. from Seoul National University and has held research positions at the University of Arizona, KAUST, Seoul National University, and the Shanghai Institute of Optics and Fine Mechanics. She is a pioneer of the Differentiable Imaging paradigm. More broadly, her research develops physics-aware and uncertainty-aware computational imaging, with Differentiable Imaging as its most developed framework – a unified approach to co-designing optics, sensors, and algorithms that addresses the sim-to-real gap in real-world computational imaging systems.

Infrared Photodetectors: From High-Performance to Intelligence

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Infrared (0.74–14 μm) photodetectors are essential for sensing systems, while the explosive growth of infrared data poses increasing challenges for processing efficiency and system integration. However, conventional photodetectors mainly function as passive sensing units and rely on separated back-end computing architectures, leading to high latency and redundant data transfer. Here, we investigate localized-field modulation in low-dimensional optoelectronic systems for intelligent infrared photodetection. By manipulating carrier transport, we demonstrate reconfigurable bipolar photoresponses that enable in-sensor spatial feature extraction and front-end image preprocessing. Building on these capabilities, this study further reveals how localized-field modulation drives the evolution of infrared photodetectors from conventional sensing units toward intelligent and integrated platforms. Moreover, under localized-field modulation, low-dimensional material platforms further enable multidimensional optical information processing and advanced heterogeneous integration, thereby reducing data transfer and power consumption.



Short Bio: Weida Hu is Fellow of IEEE, Fellow of Optica, Fellow of SPIE, the vice president of Shanghai Institute of Technical Physics of Chinese Academy of Sciences, the head of State Key Laboratory of Infrared Physics, and a full professor (Principal investigator) on infrared photodetectors and intelligent recognition chips for space applications. He has authored or coauthored more than 200 technical journal papers and conference presentations, with the total citations of 36000 and h-index of 108 (Google scholar).

Integrated Ultraviolet Optoelectronics for High-Speed Solar-Blind Optical Communication and Miniaturized Spectral Imaging

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The III-nitride family (AlN, GaN, InN, and their alloys) has been regarded as one of the most significant semiconductors, and has therefore been heavily investigated in the past two decades for various optoelectronics (LEDs, lasers, photodetectors, etc.). Excitingly, the InGaN-based light emitters have revolutionized the lighting industry, promoting energy-efficient and eco-friendly modern solid-state lighting and lasing technologies. Similarly, by alloying GaN with AlN, we can synthesize AlGaN ternary alloys with tunable direct bandgaps from 3.4 eV (GaN) to 6.1 eV (AlN), corresponding to a wide ultraviolet (UV) spectral range from 360 nm down to 210 nm. In this presentation, firstly, we will focus on our efforts for the development of highly efficient UV LED/microLED and detectors, and their monolithic integration on single platform to promote on-chip and free-space optical communication. Second, we will share our progress in searching novel GaN-based device architecture for miniaturized on-chip UV spectrometer and spectral imagers.



Short Bio: Haiding Sun is currently a Full Professor at the University of Science and Technology of China, where he is leading iGaN Laboratory focusing on the development of wide bandgap group III-nitride semiconductors for efficient ultraviolet (UV) optoelectronic devices and integrated photonics. Dr. Sun has published more than 200 peer-reviewed SCI-index journal papers, including Nature Photonics (2), Nature Electronics (3), Nature Communications (2), Science Advances, Advanced Materials (5), Light: Science and Application (Cover), Laser & Photonics Review, etc., and more than 90 conference invited/regular papers, such as IEDM (4)/CLEO(50+)/Photonics West/IEEE IPC etc. He has written 4 book chapters related to UVLEDs/lasers/detectors and holds 5 USA and 20+ Chinese Patents. He is currently an Associate Editor of IEEE Photonics Technology Letters, and Journal of Semiconductor. He is also serving as a TPC member for IEDM (Optoelectronics session)/CLEO/IEEE Photonics Conferences.

Chip-scale Spectroscopic Metrology: From Programmable Photonics to Biomedical Sensing

University of Cambridge, UK GlitterinTech, China

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Optical spectroscopy is a powerful tool for probing chemical, biological, and structural information, but bringing benchtop-level metrology into compact, real-time, and wearable systems remains challenging. In this talk, I will present our recent progress in chip-scale spectroscopic and photonic sensing platforms enabled by integrated photonics, computational reconstruction, and system-level co-design. I will discuss programmable reconstructive spectrometers with broadband picometer-scale resolution, fully packaged near-infrared sensors for quantitative material and concentration analysis, and our recent optical convolutional spectrometer that uses the convolution theorem for low-complexity, high-precision spectral retrieval. These platforms enable applications ranging from industrial and agricultural analysis to non-invasive biomedical sensing of skin hydration and blood biomarkers. I will also briefly introduce our extension of photonic spectral encoding towards direct geometric sensing for compact 3D surface profiling. Together, these results point towards intelligent chip-scale photonic sensors that can bring high-precision optical metrology from the laboratory to real-world healthcare, manufacturing and environmental applications.



Short Bio: Qixiang Cheng received his B.Eng. degree from Huazhong University of Science and Technology in 2010 and his Ph.D. degree from the University of Cambridge in 2014. He was subsequently a Research Scientist at the Lightwave Research Laboratory, Columbia University, New York, where he led research on silicon photonic device design, layout, packaging, and testing, and contributed to major US research programmes funded by ARPA-E, NSF, and DARPA. In January 2020, he returned to the University of Cambridge as a University Lecturer and was promoted to Associate Professor in 2024. He has served on the technical program committees of leading international conferences, including OFC, CLEO, CLEO-PR, ECIO, MOC, and Photonics West, and has served as an Associate Editor of Microsystems & Nanoengineering. He has authored more than 150 refereed journal and conference papers, including Nature Photonics, Nature Communications, Light: Science & Applications, Proceedings of the IEEE, Optica, and Photonics Research. He is an elected Fellow of Fitzwilliam College, University of Cambridge, and he is the founder of GlitterinTech.

Toward Next-Generation Spectral Detection: A Miniaturized High-Performance Solution

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Miniaturized spectrometers represent a significant leap forward in analytical technology, merging the power of traditional spectrometry with the convenience of portability. Miniaturization of spectrometers to sizes that can fit in the palm of hand or integrate into mobile devices would unlock the potential for instant, on-site analysis of substances in a multitude of environments. This advancement is crucial for a variety of fields including environmental monitoring, healthcare diagnostics, food safety, and forensic science, allowing for immediate decision-making and real-time data acquisition.

This presentation highlights the groundbreaking development of miniaturized, high-performance spectrometers driven by advanced computational strategies. We present a series of breakthroughs from our research group, including the world's smallest spectrometer, the world's most efficient spectrometer, and the world's cheapest spectrometer. We will discuss how these novel devices are being deployed in critical real-world applications such as defect inspection in solar power plants, non-invasive glucose monitoring, and light source detection in optical communication systems. The talk will conclude with future perspectives on AI-driven spectral sensing and its transformative potential across scientific and industrial domains.



Short Bio: Zongyin Yang completed his B.S. in Mechanical Engineering and MSc in Optical Engineering at Zhejiang University. He was awarded his PhD in Electrical Engineering from the University of Cambridge in 2019, following which he served as a postdoctoral researcher. He was selected as a Research Fellow at King's College, University of Cambridge. Zongyin is one of ten individuals to be awarded the Extraordinary Chinese Self-Financed Students Abroad in 2019. Zongyin joined Zhejiang University as a Hundred-Talent Program Professor in 2020. He got the National Science Fund for Excellent Young Scholars and was also selected as 'Innovators Under 35, China' by MIT Technology Review in 2021. He was selected as Alibaba DAMO Academy Young Scholars Award in 2023. He became a tenured professor and was selected as the Qiushi distinguished professor of Zhejiang University in 2024.

Zongyin's research is primarily focused on the miniaturization of optoelectronic devices. He has achieved significant breakthroughs, such as proposing synthesis methods for bandgap graded semiconductors and creating the world's smallest spectrometer and wavelength-tunable nanolaser. His contributions to science have been published in top-tier journals, including Science, Nature Photonics, Nature Communications, Science Advances, Light, Nano Letters, and JACS, where he is the first/corresponding author. Zongyin co-published a book with Springer Publishing Company. He holds over 35 patents in China, alongside several international patents. He is the Youth Editor of The Innovation (IF=32.1), Chinese Laser.

Reconstructive photon-counting spectrometer and its application on high-dimensional imaging

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Metasurfaces have strong ability to manipulating light, not only through its transmission and reflection, but also on its local light near the surfaces. Superconducting nanowire single-photon detectors (SNSPDs) have attractive properties such as high efficiency, low time jitter and broad operation band. Combining them on the same chip extends their applications, especially on optical sensing under ultra-faint light. In this talk, I will review our recent works on reconstructive photon-counting spectrometers based on metasurfaces and SNSPDs. Cooperating with the team from Shanghai Institute of Microsystem and Information Technology (SIMIT, CAS), we proposed and demonstrated two device designs to realize spectrum reconstruction and analysis under single-photon-level faint lights. Recently, we combined such a device with single-pixel computational imaging and the time-of-flight method, to realize a 4D imaging system with the 3D spatial information and the 1D spectral information without spatial point-wise scanning.



Short Bio: Wei Zhang received his Bachelor's degree in 1998 and Ph. D in 2003, respectively, from Tsinghua University. He is a tenured professor of Electronic Engineering Department, Tsinghua University, China. His research interests include micro/nano-photonic devices, integrated photonic quantum devices and photonic quantum information applications.

Unified Information-theoretic Framework for Adaptive Spectral Encoders

Sichuan University, China

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Compact spectrometers promise to revolutionize sensing applications, offering a unique pathway to laboratory-grade analysis within a miniaturized footprint. Central to their performance is the encoding strategy to unknown spectra, which determines the efficiency, accuracy, and adaptability of spectral reconstruction. However, the absence of a unified spectral encoding framework has hindered the realization of optimal, high-performance compact spectrometers. We propose a transformative approach: an information-theoretic framework grounded in bio-inspired Bayesian expected information gain that defines the first generic light encoder for computational spectrometers. By optimizing three fundamental attributes at the lowest level of physical hierarchy, (1) orthogonality, (2) completeness, and (3) sparsity, we establish a design paradigm that transcends conventional encoding hardware limitations. We validate this paradigm with the first generic encoder capable of dynamically reconfiguring its response matrices. Experiments show superior reconstruction fidelity across diverse spectral regimes, enabling tunable spectral encoding tailored to varied input features. An ultra-high resolution of 6 pm and a broad measurable bandwidth of 30 nm are experimentally validated. By bridging the gap between theoretical encoding principles and reconfigurable hardware, our framework defines a coherent basis for future advances in compact spectrometry.



Short Bio: Hanxiao Cui is a Professor of Aerospace Engineering at Sichuan University, China and leads the astro-propulsion lab. He gained his PhD in Engineering from University of Cambridge in 2021. By incorporating (opto)electronics with rigorous mathematical analysis, his current research focuses on optical sensing techniques for harsh environment.

Industry Discussion

Shanghai Ideaoptics Co., Ltd.,

Shanghai Engineering Research Center of Optical Metrology for Nanofabrication (SERCOM), China

Haiwei Yin

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Short Bio: Haiwei Yin received his PhD degree in Condensed Matter Physics from Fudan University. Since founding Shanghai Ideaoptics Co., Ltd. in 2011, he has served as the company's CEO, overseeing strategic planning, core technology R&D and operations. He has sustained innovations in spectral detection technology, leading the development of advanced technologies and products. To date, he has accumulated 38 invention patents and 28 utility model patents, presided over 20 government research projects at or above the provincial and ministerial levels, and published 15 papers in top international journals such as *Light: Science & Applications*, *Science Bulletin*, and etc.

Ideaoptics' products are widely used in scientific research innovation, semiconductor, optoelectronics, photonic chips, and other fields, serving over 4,000 high-quality customers and being cited in more than 3,820 SCI papers. Validated both domestically and internationally, the company has emerged as a leading high-end spectral instrument provider in China with global recognition.

Industry Discussion

Westlake University, China

Xin Yuan

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Short Bio: Xin Yuan is currently an Associate Professor at Westlake University. He was a video analysis and coding lead researcher at Bell Labs, Murray Hill, NJ, USA from 2015 to 2021. Prior to this, he had been a Post-Doctoral Associate with the Department of Electrical and Computer Engineering, Duke University from 2012 to 2015, where he was working on computational imaging and machine learning. Before joining Duke, Dr. Yuan obtained his Ph.D. from the Hong Kong Polytechnic University in 2012.

Track 6: Optical Imaging and Display Technologies

Probing Frequency-Dependent Elastic Properties in Condensed Matter via Brillouin Light Scattering

Center for Life Nano- and Neuro-Science, Italian Institute of Technology

Giancarlo Ruocco

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Brillouin light scattering (BLS) has evolved from a specialized technique in condensed matter physics into a powerful microscopy tool for non-contact, three-dimensional mechanical characterization of a wide range of materials. This review explores the application of Brillouin microscopy to probe the dynamic mechanical response of matter, spanning solid-state systems, glass-forming liquids, and complex biological materials.

While the frequency dependence of elastic moduli is well established in condensed matter physics—providing insight into structural relaxation processes and phonon dynamics—its systematic use in biological imaging is still developing. Ongoing debate persists regarding the interpretation of the Brillouin frequency shift and linewidth in soft and condensed matter, particularly in relation to macroscopic quasi-static mechanical properties.

By revisiting the fundamental principles of acoustic phonon propagation and viscoelastic dispersion, this work presents a comparative analysis of how Brillouin microscopy reveals mechanical properties across different length and time scales. We highlight the importance of interpreting these dynamics through a frequency-dependent “relaxation-time” framework grounded in generalized hydrodynamics. This approach bridges high-frequency longitudinal moduli with low-frequency biomechanical behavior, positioning Brillouin microscopy as a key technique for multiscale mechanical characterization of complex biological systems and functional materials.



Short Bio: Giancarlo Ruocco is full professor of Condensed Matter Physics at Sapienza University of Rome since 2000. His expertise is in the development of new instrumentations for the spectroscopic investigation of disordered solids, glasses and liquids. More recently his interest moved towards the development of new imaging techniques for studying biosystems. In 2004, he founded and directed (until 2008) the

Research Center "SOFT" of the INFM. From Nov 2007 to Gen 2013 he has been the director of the Physics Department at Sapienza. From 2010 to 2014 he has been vice-rector for the politics of the research at “Sapienza” University of Rome. Since 2011 he is the director of the “Center for Life Nano- and Neuro-Science (CLN²S)”, a laboratory of the Italian Institute of Technology (IIT) where he is also senior scientist and principal investigator of the research line “Nanotechnology for Neuroscience”. His research line hosts about 30 Post Docs and 20 PhD students from different disciplines (Biologists, Chemists, Engineers, Medical doctors, Physicists). In 2019 he has been awarded by a ERC Synergy grant for the study of protein aggregation in neurodegenerative disease and in 2023 by a EIC Pathfinder Open for the development of Brillouin microscopy. He is the scientific director of two industrial joint laboratories (one devoted to innovative microscopy techniques, the other to the development of biosensors for the early detection of neurodegenerative diseases). He is author of 500+ publications. He is member elected of the National Academy of Science of Ukraine, of the Academia Europaea and of the European Academy of Science. For a detailed description of Giancarlo Ruocco’s activities in the period

1990-2015 see: 10.5488/CMP.22.40101 (Giancarlo Ruocco: from inelastic X-ray scattering to neuroscience, Condensed Matter Physics, 2019, 22, 40101).

Restoring the Unseen: Learning-based Inverse Problems from Multi-degradation Imaging to Lensless Cameras

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Se Young Chun

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Imaging systems recover scenes only indirectly, through measurements degraded by noise, blur, weather, or the heavy multiplexing of mask-based sensors. As the forward operator A in $y = Ax + n$ becomes large, compound, or severely ill-posed, classical regularizers reach their limits. This talk introduces four recent works of my lab along two complementary paradigms. The first addresses supervised learning under multiple degradations: ADMS allocates sparse degradation-specific filters (~3%) via FAIG-based attribution, while CoLoRA combines contribution-based low-rank adapters with random-order-degradation pre-training to match full fine-tuning at ~7% cost. The second concerns zero-shot diffusion posterior sampling: TriPS reformulates sampling as a time-varying control problem over data-consistency, classifier-free guidance, and stochasticity, optimized via template search and GRPO-based reinforcement learning. The final work, Dilack, extends this approach to lensless imaging through pseudo-inverse anchor fidelity and masked step-wise constraints. Across these works, lightweight adaptation tightly coupled to the forward model consistently outperforms brute-force tuning.



Short Bio: Se Young Chun received his B.S.E. degree in EE from Seoul National University and his Ph.D. degree in EE: systems from the University of Michigan - Ann Arbor. He was a research fellow at Harvard Medical School and a research fellow at the University of Michigan - Ann Arbor. He has joined ECE, Seoul National University, Seoul, South Korea and is currently a full professor. He is a senior area editor of IEEE Transactions on Computational Imaging and was the recipient of the 2015 Bruce

Hasegawa Young Investigator Medical Imaging Science Award from the IEEE Nuclear and Plasma Sciences Society.

Non-line-of-sight imaging on arbitrary relay surfaces

Tsinghua University, China

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Non-line-of-sight (NLOS) imaging aims to recover hidden objects using a relay surface, with potential applications such as autonomous driving and robotic vision. Most existing methods rely on planar-wall and dense-sampling assumptions, which limits real-world deployment. We propose a LOS-guided NLOS imaging pipeline that removes these constraints, supporting arbitrary relay surfaces and both confocal and non-confocal configurations. Our approach represents the hidden scene with 3D Gaussian primitives and uses a differentiable transient renderer for end-to-end optimization. Validated on public and custom datasets, our method achieves high-quality reconstruction under sparse, spatially limited conditions.



Short Bio: Xing Fu received his BS and PhD degrees from Tsinghua University, China. He is currently a professor in the Department of Precision Instrument, Tsinghua University. His research interests include single-photon detection, optical field manipulation, and solid-state lasers. He has published over 100 papers in peer-reviewed journals including *Light: Science & Applications*, *Nature Communications*, and *Photonix*, with several papers selected as ESI hot paper and highly cited paper. He is the recipient of Dimitris N. Chorafas Prize and Wangdaheng Optics Award. He serves as the deputy director of Key Laboratory of Photonic Control Technology, Ministry of Education, deputy dean of Weixian College, Tsinghua University, as well as special committee member of Chinese Optical Society and Chinese Society for Optical Engineering.

“Extended” Imaging & Display: Mixing Optics, Graphics, and AI

The University of Hong Kong, Hong Kong SAR

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Computational imaging, incorporating lightweight optics, coded-aperture modulation, and tailored image-processing neural networks, has recently garnered attention in intelligent domain-specific visual tasks. This talk covers representative imaging scenarios that seek to retrieve and deliver information beyond just 2D color intensities, namely, hyperspectral and RGBD imaging, polarization-aided reconstruction, event-based sensory for unconventional lighting, as well as light field and holographic displays. By leveraging the optics-image processing joint design flow, this neural imaging paradigm shows “extended” performance over conventional heuristic imaging and display systems.



Short Bio: Evan Y. Peng is an Assistant Professor at the University of Hong Kong. He was a postdoctoral research scholar at Stanford University and received his PhD from the University of British Columbia, and both his MS and BS from Zhejiang University. Peng has been working on a family of Neural + X projects for cameras, displays, sensors, and rendering, and is the recipient of the IEEE VR Tech Significant New Researcher Award (2023), AsiaGraphics Young Researcher Award (2022), ICBS Frontiers of Sciences Award (2023), and SID (China) Outstanding Display Tech Young Talent of the Year Award (2024). In addition, Peng has served as the Chair for EEE ICCP 2026, ACM SIGGRAPH Asia XR (2025), and IEEE ISMAR Conference Papers (2023). Peng is also the Co-Founder and Executive Manager of the TechBlog (WeChat Official Account) IntelligentOptics.

Post-Imaging Era: Optical Pre-sensor Computing

Tsinghua University, China

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The Post-imaging Era is defined by the shift from traditional optical recording of physical reality to algorithm-driven generation, computational reconstruction and AI-mediated visual production, where the boundary between reality and synthetic imagery becomes blurred. Traditional optical components have also shifted from being imaging-oriented to information-acquisition-oriented, giving rise to the concept of optical pre-sensor computation, an emerging computing paradigm that refers to the direct modulation or computation of optical information by introducing specific optical elements into the optical path before signal capture. This approach enables information extraction or compression at the early stage of data generation, reducing reliance on back-end computational resources and data transmission frequency, while leveraging the inherent advantages of optical computing to achieve deep integration of sensing and computing. It offers a novel technological pathway to overcome the energy efficiency bottleneck of traditional architectures. Looking forward, this emerging paradigm holds great promise for breaking the fundamental barriers of conventional computing architectures, paving the way for a new generation of intelligent visual systems.



Short Bio: Hongwei Chen is currently a full professor in the Department of Electronic Engineering, Tsinghua University. He is a senior member of IEEE and OPTICA. His current research interests include opto-electronic signal processing, photonic intelligence, silicon photonics and microwave photonics. He has published over 100 papers on top-level journals, including Nature Communications, Science Advances, Nature Nanotechnology, Light Science&Applications. His scientific achievements have been reported by media including MIT Technology Review, SPIE newsroom, EurekaAlert, China Science Daily, ScienceNet, etc.

Computational imaging with randomness

The University of Tokyo, Japan

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Computational imaging is a powerful framework for designing imaging systems by integrating optics and information science. In particular, state-of-the-art technologies in information science, such as compressive sensing and deep learning, are advancing the field of computational imaging. In this talk, I will present our recent research activities on computational imaging with random optical modulations, such as those induced by scattering media.



Short Bio: Ryoichi Horisaki is a professor in the Department of Information Physics and Computing, Graduate School of Information Science and Technology, The University of Tokyo, Tokyo, Japan. He received the B.S. degree from Engineering from Nara National College of Technology, Japan in 2005, and his M.S. and PhD degrees from Information science from Osaka University in 2007 and 2010, respectively.

Single-pixel near infrared hyperspectral imaging with optoelectronic spectrum modulation

Shandong University, China

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Near-infrared (NIR) hyperspectral imaging is a powerful technique that enables the capture of three-dimensional (3D) spectra-spatial information within the NIR spectral range, offering a wide array of applications. However, the high cost associated with InGaAs focal plane array (FPA) has impeded the widespread adoption of NIR hyperspectral imaging. Addressing this challenge, in this study, we adopt an alternative approach—single-pixel detection for NIR hyperspectral imaging. Our investigation reveals that single-pixel detection outperforms conventional FPA, delivering a superior signal-to-noise ratio (SNR) for both spectral and imaging reconstruction.

To implement this strategy, we develop two types of optoelectronic spectrum modulation. In our first work, we leverage self-assembled colloidal quantum dots (CQDs) and a digital micromirror device (DMD) for NIR spectral and spatial information multiplexing, complemented by single-pixel detection for simultaneous spectral and image reconstruction. Our experimental results demonstrate successful NIR hyperspectral imaging with a detection window about 600 nm and an average spectral resolution of 8.6 nm with a pixel resolution of 128×128 . In a second work, we propose a novel nonlinear spectral-modulated fiber laser as illumination source, demonstrating a compact and low-cost systematic structure. By circumventing the need for expensive and bulky FPA and wavelength selection components, our solution shows promise in advancing affordable and accessible NIR hyperspectral imaging technologies, thereby expanding the range of potential applications. Combining with wavelength multiplexing and compressed sensing, calculated minimum spectral resolution of 1.37 nm can be realized based on the measurement of integrated transmitted/reflected spectral intensity of illuminated object.



Short Bio: Sun Baoqing received his PhD degree in Physics from University of Glasgow. He is a professor at Shandong University. He now leads a research group of about 20 people including postgraduate students. His research interests include but not limited in computational imaging, quantum imaging and novel imaging technologies. He publishes more than 30 papers in related area. He is also members of several national academic committees.

A deep artifact removal approach for multi-core fiber imaging

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Multi-core fiber imaging is essential for minimally invasive endoscopy in medicine and industrial inspection. We present a lensless multi-core fiber imaging approach based on Spectral-Guided Artifact Removal Network. In this framework, a physics informed prior is embedded in a lightweight SpectralGate module to suppress lattice-frequency artifacts in the feature domain. The experimental results indicate superior performance over previous methods. These results demonstrate potential for practical deployment in compact and safer biomedical endoscopes. This work is published at Light: Advanced Manufacturing in the year of 2026.



Short Bio: Liangcai Cao received his BS/MS and PhD degrees from Harbin Institute of Technology and Tsinghua University, in 1999/2001 and 2005, respectively. Then he became an assistant professor at the Department of Precision Instruments, Tsinghua University. He is now tenured professor at Tsinghua University. He was a visiting scholar at UC Santa Cruz and MIT in 2009 and 2014, respectively. His research interests are holographic imaging and holographic display. He is a Fellow of the Optica and the SPIE.

Capture molecular movies with ultrafast photons and electrons: from isolated gas-phase to liquid- and solid-phase samples

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Atoms and molecules serve as the fundamental building blocks of our natural world. In the case of the ground state hydrogen atom, its size is approximately 52.92 picometers (radius), with the classical period of its electron being 150 attoseconds. At the microscopic level, electrons and nuclei exhibit rapid movement, vibration, or rotation, and their dynamics significantly influence macroscopic physical, chemical, and biological processes. Capturing molecular movies with temporal resolution in the (sub)femtosecond range and spatial resolution in the picometer scale has long been a goal for physicists, chemists, and biologists. Recent advancements in hard X-ray free electron lasers and femtosecond electron pulses are bringing us closer to realizing this goal through femtosecond hard X-ray imaging and ultrafast electron diffraction.

In this talk, I will present our home-built ultrafast electron diffraction setup for imaging gas-phase, liquid-phase, and solid-phase samples, along with our newly constructed ultra-high vacuum system, which integrates argon ion sputtering cleaning, quadrupole mass spectrometry, Low Energy Electron Diffraction (LEED), Auger Electron Spectroscopy (AES), Thermal Desorption Spectroscopy (TDS), and femtosecond-resolved polarization and azimuthal-dependent sum frequency generation spectroscopy, for studying ultrafast dynamics at solid-gas and solid-liquid interfaces.



Short Bio: Zhipeng Huang is currently a permanent laser scientist working at the TU Dortmund University and a guest scientist at the Max-Planck Institute for the Structure and Dynamics of Matter. He received his Bachelor degree in physics from Shandong University in 2011. After completing his bachelor's studies, he joined the research group of Prof. Junhao Chu (Academician of the Chinese Academy of Sciences) at the Shanghai

Center for Photovoltaics as a graduate student with exempting from the admission exam. During his graduate studies, he worked in Prof. James R. Sites's group at Colorado State University as a visiting scholar from 2013 to 2014. In November 2013, he received a Doctoral fellowship supported by the Joachim Herz Foundation and the PIER Helmholtz Graduate School and joined the research group of Prof. Jochen Küpper and Prof. Henry N. Chapman (Fellow of the Royal Society) at Deutsches Elektronen-Synchrotron (DESY) as a PhD student. He obtained his Doctoral degree (Dr. rer. nat.) from DESY and the University of Hamburg in May 2019. After submitting his dissertation, he worked in the research group of Prof. R. J. Dwayne Miller (Fellow of the Royal Society of Canada) at the Max-Planck Institute for the Structure and Dynamics of Matter as a postdoc from 2018 to 2020. In July 2020, he joined Prof. R. Kramer Campen's research group at the University of Duisburg-Essen, initially as a postdoc from 2020 to 2022 and later as a senior research associate until 2024. In April 2024, he joined the center for synchrotron radiation in TU Dortmund University as a permanent staff scientist.

His research interests focus on imaging the ultrafast electron and nuclear/lattice dynamics of samples (from isolated gas-phase molecules, liquids, solids, solid-liquid/solid-gas interfaces to electrochemical cells) under ultrashort optical excitation using ultrafast electron/X-ray imaging and spectroscopy

techniques. He is an experienced experimental physicist with expertise in ultra-high vacuum apparatus development, device control, data acquisition/analysis automation, laser-driven molecular source development, ultrafast electron diffraction, mass spectrometry, non-linear optics/spectroscopies, etc., and has successfully developed/constructed several state-of-the-art scientific instruments (e.g. a scientific instrument which combines a laser-induced acoustic desorption molecular source with a time-of-flight mass spectrometer for free-electron laser experiments (Huang et al., *Anal Chem* 90, 3920-3927 (2018)), a scientific instrument which combines a laser-driven molecular beam with a table-top femtosecond electron gun and a pulsed bright-field optical microscope (Huang et al., *Structural Dynamics* 9, 054301 (2022)), an ultra-high vacuum system which integrates low energy electron diffraction, auger electron spectroscopy, thermal desorption spectroscopy, time-resolved sum frequency generation spectroscopy, etc.) to perform these cutting-edge research (Huang et al., *Review of Scientific Instruments*, 95, 063903 (2024)).

Optical Pin Beam and Its Generalized Applications

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Optical pin beams (OPBs) represent a novel class of structured light fields engineered for resilient, long-distance propagation. Their exceptional stability and strong resistance to atmospheric turbulence make them a compelling alternative to conventional Gaussian and other structured beams for free-space optical systems. This talk provides a comprehensive overview of the physical principles, generation strategies, experimental realizations, and emerging applications of OPBs. By precise spatial modulation of the optical wave vectors distribution, OPBs achieve highly collimated, self-reconstructing propagation with distinctive pin-like features that confer remarkable robustness and self-healing capability. We further discuss several OPB derivatives—including vortex, inverted, and vortex-inverted OPBs—which expand the functional landscape by enabling flexible control over amplitude, phase, polarization, and orbital angular momentum. Experimentally, OPBs have demonstrated outstanding performance across diverse platforms, ranging from free-space and underwater optical communications to optical trapping and super-resolution imaging. With their unique combination of propagation stability, light-field tunability, and environmental adaptability, OPBs hold strong promise for next-generation optical communication, precision sensing, and advanced imaging technologies.



Short Bio: Ze Zhang, Professor and Dean at Aerospace Information Technology University. He also serves as an expert for the Central Military Commission Science and Technology Commission & CAS, and an adjunct professor at BUPT and CUGB. His research focuses on stable laser field and super-resolution imaging. He has presided over major key projects including the 173 Program, NSFC general projects and national defense major research programs. He has published over 50 papers, with cover articles in PRL and other top journals. His achievements were selected as World Optics Highlights in 2019 and 2021, and he won the First-ranked Second Prize of Beijing Natural Science Award in 2022.

Research on Multidimensional Information Decoupling in Scattered Optical Fields

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Imaging through scattering media remains a hard frontier in biomedicine, detection, and tracking. Scattering scrambles structured wavefronts into speckle, mixing and erasing spatial, physical, and geometric information. The key is to disentangle those dimensions from the mixed field.

This work analyzes how multidimensional information propagates in speckle and builds a pathway from imaging to sensing to dimensional lifting. By decomposing deformation and displacement cues in speckle, it removes reliance on shape invariance and strong priors, extending tracking beyond the memory effect range for dynamic localization and reconstruction. It then decouples 2D spatial information to break memory effect limits and enable large field-of-view imaging. Finally, deep learning enables a shift from intensity to polarization sensing, decoding vector polarization to recover 3D geometry. Overall, it shows scattered light as a rich information carrier and supports next generation optical imaging.



Short Bio: Fei Liu: Professor, Ph.D. Supervisor, National-Level Young Talent, and Shaanxi Provincial Distinguished Young Scholar. Deputy Director of the Xi'an Key Laboratory of Computational Imaging, and Visiting Professor at the National Key Laboratory of Science and Technology on Optical Information Control and Security. Currently serving as Associate Editor of Advanced Imaging and Editorial Board Member of journals including Optics & Lasers in Engineering and an OPTICA Travel Lecturer.

He has published over 40 papers in leading optics journals such as Light: Science & Applications, Photonix, Opto-Electronic Advances, and Opto-Electronic Science, with more than 4,800 citations.

Single-pixel Temporal single photon LiDAR

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Temporal single-photon (TSP-) LiDAR presents a promising solution for imaging-free target recognition over long distances with reduced size, cost, and power consumption. However, existing TSP-LiDAR approaches are ineffective in handling open-set scenarios where unknown targets emerge, and they suffer significant performance degradation under low signal-to-noise ratio (SNR) and short acquisition times (fewer photons). Here, we report our recent developments on TSP-LiDAR, including long distance drone identification, and semantic TSP-LiDAR.



Short Bio: Shihai Sun received his PhD degree in Physics from National University of Defense Technology. He is a professor of Sun Yet-sen University, China.

Background-Oriented Schlieren Tomography for Flow Diagnostics

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Background-oriented schlieren tomography (BOST) is a powerful and versatile technique for three-dimensional flow diagnostics, enabling the reconstruction of refractive index fields and related physical quantities such as density and temperature distributions in complex turbulent flows. Despite its wide adoption, conventional voxel-based BOST methods suffer from inherent limitations including coarse spatial resolution, significant discretization errors, poor noise immunity, and prohibitive computational costs. This talk presents our recent advances in addressing these challenges through two novel reconstruction frameworks. First, we introduce the Neural Refractive Index Field (NeRIF), which employs a compact neural network to implicitly represent the three-dimensional flow field as a continuous function, bypassing voxel-based discretization entirely. By adopting tailored random sampling strategies and cross-validated gradient outputs, NeRIF achieves superior reconstruction accuracy, enhanced spatial resolution approaching camera pixel limits, and drastically reduced memory requirements. Numerical simulations and experimental validation on turbulent Bunsen flames demonstrate compelling improvements over state-of-the-art methods. Second, we present a tensor decomposition-based four-dimensional (3D+t) BOST framework for high-speed, time-resolved flow field reconstruction. By organizing the spatiotemporal data as a four-dimensional tensor and applying hybrid decomposition strategies, this approach synergistically combines tensor factorization with lightweight neural networks to encode high-frequency flow features, while a dedicated ray-path correction module compensates for light deflection in large-gradient refractive index fields. The method achieves a reconstruction speed of approximately 9.6–12.6 seconds per frame without pre-training, markedly outperforming conventional iterative solvers, with SSIM exceeding 0.99 in synthetic evaluations. Together, these two contributions advance the frontier of BOST towards physics-informed, data-efficient, and computationally practical volumetric flow diagnostics.



Short Bio: Weiwei Cai is a Professor in the School of Mechanical Engineering at Shanghai Jiao Tong University (SJTU), China. He received his Ph.D. degree from SJTU and subsequently conducted postdoctoral research at Stanford University. His research interests center on optical flow diagnostics, laser spectroscopy, and the application of machine learning and physics-informed neural networks to combustion and turbulent flow measurements. Prof. Cai has pioneered the integration of background-oriented schlieren

tomography with neural network-based reconstruction algorithms, including the neural refractive index field (NeRIF) and tensor decomposition-based four-dimensional BOST frameworks, which significantly advance the accuracy, resolution, and efficiency of volumetric flow visualization. He has published extensively in leading journals and his work has been supported by the National Natural Science Foundation of China.

From “Sensing-with-Computing” to Photonics-Electronics-Mixing ICs for Emerging Computing Power Requirements

Tsinghua University, China

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Guided by the first-principles design philosophy that “every interface is a bottleneck,” this report examines how to break through the major interface constraints that limit the performance of intelligent sensing integrated systems, including physical-to-information interfaces, data-conversion interfaces, memory-access interfaces, communication interfaces, and energy-supply interfaces, etc. It presents Sense Lab’s work on sensing-with-computing architectures and chips spanning pre-sensing, in-sensor, and near-sensor computing, and highlights its exploration of ultra-high computing capability and energy efficiency at the sensing edge. The report further discusses ongoing efforts toward next-generation photonic-electronic hybrid computing integrated systems, where sensing interfaces are expanded into richer physical dimensions.



Short Bio: Fei Qiao received his PhD degree in Electronic Engineering and IC Designs from Tsinghua University. He is an associate professor of Tsinghua University, China, and his research interest is focusing on Photonics-Electronics-Mixing ICs and Smart Sensing ICs.

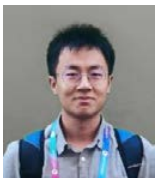
Characterizing complex wavefields with a high-resolution computational wavefront sensor

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Optical waves encode rich information in their spatial profiles and topological structures, making wavefront characterization a key requirement for applications including adaptive optics, wavefront shaping, label-free imaging, optical communication, surface profilometry, and imaging through scattering. However, existing wavefront sensing techniques such as Shack-Hartmann wavefront sensing, shearing interferometry, digital holography, and pyramid wavefront sensing, often face trade-offs between spatiotemporal resolution, compactness, and versatility. Here, we introduce spatial and Fourier-domain adaptive regularized inversion (SAFARI), a computational wavefront sensing method that leverages intrinsic physical properties, such as wavefront smoothness, to reconstruct complex wavefronts reliably from a single exposure. Using a compact diffuser-based sensor, we experimentally demonstrated single-shot, reference-free characterization of diverse complex wavefronts, including aberrations with up to 200 Zernike modes, structured beams with a topological charge of 150, and speckle fields comprising over 190,000 spatial modes. We also studied and validated the compatibility of SAFARI with a broader class of wavefront sensors, including Shack-Hartmann wavefront sensors and quadri-wave lateral shearing interferometers. The most prominent feature of our wavefront sensing approach is its unprecedented generalizability while maintaining comparable or even superior performance compared with existing task-specific, state-of-the-art solutions. The results highlight its potential for coherent imaging and sensing at unprecedented resolution and complexity.



Short Bio: Yunhui Gao is currently working at Prof. Liangcai Cao's lab at the Department of Precision Instrument, Tsinghua University, China. His research interests include computational imaging and holography. He has published first-author papers in journals including *Light: Science & Applications*, *Light: Advanced Manufacturing*, *Photonix*, and *Optica*. He is the recipient of the first prize in the 2023 Light Doctoral Academic League, ISOM'25 Student Award, and 2020 SPIE Optics and Photonics Education Scholarship.

Track 7: Biophotonics and Medical Optics

Can personalized PDT treatment planning provide clinically significant improvements?

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Photodynamic Therapy, gains increasing acceptance in oncology for a range of indications, ranging from basal cell carcinoma to glioma. While surface proximal therapies, such as skin or bladder carcinoma, have high long term cure rates, with the current standardized treatment plans, the success for deep-seated malignancies such as Brain tumours, is limited. Personalized treatment plans based on the tumour size and location have been shown to improve the number of patients with significantly longer-term survivals; however, the fraction of patients not benefiting at all from the intervention remains constant.

While controlling the fluence rate within the confines of the known tissue optical properties has made significant advances, most treatment plans still assume homogenous photosensitizer and oxygen concentrations. We demonstrate that photosensitizer concentration variations on the mm scale can impact treatment planning solutions.

Methods to predict the tissue optical properties, the photosensitizer and oxygen availability, spatially resolved, based on vascular imaging prior to treatment planning and during PDT delivery are discussed. Current treatment plan approaches will be presented.



Short Bio: Lothar Lilge obtained the M.Sc. from the Johann Wolfgang Goethe University in Frankfurt, and Ph.D. from the Westfälische Wilhelms University in Muenster. Further training he received at the Wellman Laboratory of Photomedicine at the Mass General Hospital in Boston. At present, he holds faculty appointments at the University of Toronto (Canada) and Johannesburg (South Africa) and is Senior Scientist at the Princess Margaret Cancer Centre, Toronto, Canada.

Computational imaging without computer and quantum imaging without detected light

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Juergen Czarske

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Deep learning has dynamically advanced the field of optical imaging. More than 40 Nobel Prizes have been awarded for optics, including the 2022 Nobel Prize for quantum technique of second generation. Recently, new perspectives for physics-informed deep learning-based imaging have been presented. However, the speed has been limited by the computing power. We propose an optical diffractive neural network for computational imaging through scattering media at the speed of light. This real-time information processing without the use of an electronic computer is attractive for mode decomposition in fibers. Furthermore, perspectives for quantum imaging without detecting light from the sample are highlighted. Chemically selective, label-free imaging offers advantages in the infrared range (IR), but adequate IR detection techniques are often lacking. Quantum approaches offer great potential through the application of entangled photon pairs for imaging with undetected light, as no IR detector is required. There remains considerable untapped innovation potential in information technology and biomedicine, so fundamental insights for scientific progress and applications are to be expected.



Short Bio: Juergen Czarske is director of the BIOLAS center (Biomedical Computational Laser Systems) and Institute for Circuits and Systems of TU Dresden. He is Member of Fraunhofer Society, Excellence Cluster Physics of Life, EKFZ Center for Digital Health, BrainLinks and BrainTools and visiting professor in Arizona (Wyant College), at USST, SIOM and CORE (Japan). Prof Czarske's awards include the 2019 OPTICA Joseph-Fraunhofer-Award / Robert-M.-Burley-Prize, 2020 Laser Instrumentation Award of IEEE Photonics Society, 2022 SPIE Chandra S Vikram Award and 2024 SPIE Dennis Gabor Award. Prof Czarske is editor of Light Science and Applications, Advanced Photonics, Advanced Imaging, Light Advanced Manufacturing, Photonics. He is Vice President of International Commission for Optics, ICO, and was the general chair of the world congress ICO-25 with 3 Nobel laureates and attendees from 55 countries.

Super-resolution structured illumination microscopy: polarization, anisotropy, and lattice

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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. 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. 3I-SIM improves the temporal resolution to 1697 Hz, with 13-hour long SR imaging of neuron growth cone.



Short 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.

Advancing Quantitative Phase Imaging with Lensless Fiber Endomicroscopy

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Minimally invasive, high-resolution imaging remains a challenge in biophotonics, while traditional endoscopes often compromise between resolution and probe size. In this talk, I will introduce lensless fiber endomicroscopy, an emerging paradigm that combines ultra-thin probes with holographic detection and computational holographic wavefront shaping to deliver label-free, three-dimensional imaging. Beyond morphology, this technology uniquely enables targeted light delivery, which can be implemented for in vivo optical manipulation. I will highlight clinical and research applications including dynamic cellular monitoring, and tissue imaging. By merging ultra-thin hardware with advanced computational imaging, lensless fiber endomicroscopy can represent a transformative leap in biophotonic tools, facilitating real-time, deep-tissue insights with unprecedented minimal invasiveness.



Short Bio: Jiawei Sun is a Professor at Suzhou Institute of Biomedical Engineering and Technology (SIBET), Chinese Academy of Sciences. He serves as Deputy Director of the Jiangsu Key Laboratory for Advanced Theranostics and Medical Instrumentation. He earned his Ph.D. with highest distinction (summa cum laude) from Dresden University of Technology, Germany. He has been awarded the National Excellent Young Scientists Fund (Overseas), and recognized with the Siegfried Werth Prize and Heinrich

Barkhausen Prize. Prof. Sun's research focuses on lensless fiber-optic imaging, optical tomography, and quantitative phase imaging, with publications in *Light: Science & Applications*, *Nature Communications*, *Photonix*. He is an Executive Committee Member of the OPTICA Optical Trapping Technical Group and a member of SPIE, OPTICA, and IEEE.

Nanometer Precision Single Molecule Localization with Raster Scanning Fluorescence Microscopes: Benchmarking RASTMIN, RASTMAX, and RASTED

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Localizing single fluorescent molecules using sequences of spatially displaced structured beams enables nanometer-scale precision, with MINFLUX setting the standard for photon efficiency. More recently, a common theoretical framework for such methods enabled the identification of raster-scanning techniques with similar potential: RASTMIN, RASTMAX, and RASTED. These are particularly interesting as they can be implemented on standard scanning fluorescence microscopes with minimal adaptations. RASTMAX has been shown experimentally, although with a focus on lifetime applications rather than on localization precision^{4,5}. Various reports showing single-molecule STED measurements indicate that RASTED is experimentally viable. RASTMIN has already been demonstrated experimentally, achieving MINFLUX-level localization precision using conventional hardware.

In this talk I will present a systematic comparison of RASTMIN, RASTMAX, and RASTED implemented on the same scanning microscope. Using both simulations and single-molecule measurements, we benchmark localization precision, photon efficiency, robustness to background, throughput, and practical implementation of each method.

These results establish practical regimes in which each raster-beam method is optimal and show that nanometer-scale single molecule localization can be broadly achieved on standard scanning microscopes.



Short Bio: Fernando D. Stefani is an Argentine physicist and nanotechnology researcher internationally recognized for his contributions to nanophotonics, super-resolution optical microscopy, and the manipulation of light–matter interactions at the nanoscale. He is a Superior Investigator at Argentina’s National Scientific and Technical Research Council (CONICET), Full Professor of Experimental Physics at the University of Buenos Aires (UBA), and Director of the Center for Bionanoscience Research (CIBION, CONICET).

Born in Buenos Aires in 1975, Stefani earned his degree in Materials Engineering in Argentina and completed his PhD in Chemistry at Johannes Gutenberg University Mainz in collaboration with the Max Planck Institute for Polymer Research. His early scientific career developed in leading European centers, including postdoctoral work at the Max Planck Institute, research at the Institute of Photonic Sciences (ICFO) in Barcelona, and group leadership roles at Ludwig Maximilian University of Munich and within the Max Planck Society, where he collaborated with Nobel laureate Stefan W. Hell.

Stefani’s research focuses on fluorescence nanoscopy, optical antennas, plasmonics, and single-molecule spectroscopy, with applications ranging from fundamental photophysics to biological imaging and biosensing. Among other achievements, his work has helped push optical microscopy beyond the classical diffraction limit.

Throughout his career, he has received numerous distinctions, including the Otto Hahn Medal of the Max

Planck Society, the Houssay Prize of the Argentine Ministry of Science, the Georg Forster Research Award of the Alexander von Humboldt Foundation, and the Konex Award, reflecting his scientific impact and leadership in Argentina and abroad.

Free-space SPAD array-based diffuse optical tomography facilitates in vivo functional imaging

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Free-space diffuse optical tomography (DOT) enables non-contact deep-tissue functional imaging, offering advantages for intraoperative guidance and wound monitoring beyond contact-mode systems. While single-photon avalanche diode (SPAD)-based DOT provides high temporal resolution, its sparse sampling property necessitates accurate detection modeling for the subsequent robust reconstruction. We introduce NeuDM, an implicit neural representation (INR) framework that learns continuous 3D pixel-dependent point spread functions, capturing optical aberrations and misalignments in the SPAD array without explicit geometric calibration. Experiments on tissue phantoms demonstrate improved agreement between simulated and measured temporal profiles, and enables precise unmixing of absorption and scattering contrasts. In vivo longitudinal tumor monitoring reveals absorption/scattering dynamics correlating with MRI findings. This unified physics-informed neural approach establishes a robust paradigm for free-space DOT, expanding its applications in both preclinical research and clinical diagnostics.



Short Bio: Wuwei Ren received his PhD degree in Biomedical Engineering from ETH Zurich, Switzerland. He is an assistant professor/PI at ShanghaiTech University, China.

Miniature Bessel-beam two-photon microscopy enables high-throughput brain imaging in freely moving mice

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Imaging neural activity across large brain volumes at subcellular resolution without disrupting natural animal behavior remains a significant challenge. Compared to the widely used Gaussian beam, the Bessel beam offers distinct advantages in two-photon imaging, including an extended depth of field, higher lateral resolution, and greater robustness to optical aberrations. Leveraging these unique properties, we developed a high-throughput miniature Bessel-beam two-photon microscope (miniBB2p) capable of long-term imaging of calcium dynamics in neurons and dendrites across a volume of $420 \times 420 \times 80 \mu\text{m}^3$ in freely moving mice. Constructed from commercially available components, miniBB2p has a light weight of 2.6 grams and features a minimalist, cost-effective design with reduced tethering stress and maximized fluorescence collection efficiency. We systematically characterized the performance of miniBB2p and validated its applicability across various behavioral paradigms. For instance, miniBB2p can simultaneously record calcium activity from over 1,000 neurons in the anterior cingulate cortex and motor cortex of freely moving mice. We anticipate miniBB2p will serve as a powerful tool for unraveling the structural and functional dynamics of large-scale neural circuits during natural behaviors.



Short Bio: Jianglai Wu is a Principal Investigator at the Chinese Institute for Brain Research, Beijing. He received his Ph.D. in Physics from Hong Kong Baptist University. His research focuses on developing optical microscopes for brain science.

Reconfiguring Laser Sources for Microscopy: Embedding Imaging Functions into the Source

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In optical imaging systems, laser sources and imaging techniques are traditionally designed and optimized separately, approaching their individual performance limits but lacking global co-optimization. We propose to unify these two aspects into a single framework of optical imaging laser technology. In prior studies, we developed laser-driven control strategies spanning solid-state-laser-based photoacoustic microscopy, fiber-laser-based multiphoton microscopy, and spatiotemporal encoding in laser scanning, enabling high-efficiency and high-speed imaging. Building on this, our future work aims to embed imaging functionalities directly into the laser source, enabling coordinated control of spectral and spatiotemporal parameters at the source level. This integration is expected to unlock new regimes of performance consistency and quantitative imaging, while reducing system complexity and footprint, ultimately for intelligent imaging platforms and exploring performance regimes inaccessible to conventional separated architectures.



Short Bio: Hongsen HE received his Ph.D. degree in 2022 from The University of Hong Kong, and then joined Xiamen University. His research focuses on “optical imaging laser technology”, aiming to transform lasers from passive illumination sources into active, imaging-function-encoded tools for next-generation intelligent microscopy systems. His work spans spectral and spatiotemporal control of light, moving beyond conventional laser and imaging architectures toward source-integrated designs. He has developed laser-driven strategies for multiphoton and photoacoustic microscopy. He has published in journals including *Advanced Photonics*, *Photonics Research*, and *ACS Photonics*.

Rapid Tomographic Multiphoton Fluorescence Lifetime Imaging

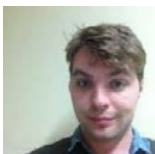
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Time-correlated single-photon counting (TCSPC) is an exceptionally precise technique to determine the fluorescence lifetime of a molecule. By exciting a sample with pulsed laser light and measuring the arrival time of the fluorescent photons the lifetime may be determined. Whilst TCSPC is extremely accurate method for determining lifetime, it requires long exposure times often on the order of several minutes for a single image acquisition. To mitigate this, researchers have developed two main strategies aimed at accelerating lifetime imaging. i) Parallelization of the imaging readout. Whilst this has achieved improvement in imaging frame rates, SPAD arrays are themselves inefficient ii) Alternatively, compressive imaging techniques can be used to accelerate lifetime imaging frame rates whilst using conventional “bucket” detection systems. Here, spatial patterns are encoded into the excitation light. The resultant image can then be recovered by applying an optimization algorithm.

In this work, we show how a compressive tomographic approach may be used to accelerate FLIM imaging acquisition speeds. The sample is excited with a line beam projected at different angles and a Lucy-Richardson algorithm is then used to recover the image at each time gate recorded by the card. Ultimately, the tomographic approach is shown to yield accurate lifetime and intensity reconstruction at less than 5% of the equivalent raster scanning acquisition time.



Short Bio: Liam Collard received his PhD degree in Chemistry and Mathematics from University of Leicester, United Kingdom. He is a researcher at King's College London.

Chiral photon-phonon Brillouin interaction: in twisted photonic crystal fiber and biophotonic applications

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Brillouin microscopy can assess mechanical features of biological samples, but suffers from weak signals owing to the low cross-section of spontaneous Brillouin scattering. Stimulated Brillouin scattering (SBS) provides a powerful and flexible mechanism to augment the signal strength. The twisted photonic crystal fibres (PCF) can robustly preserve optical modes with circular polarization states and optical vortices over long distances. Here, I would like to share some recent progresses on chiral photon-phonon Brillouin interaction in twisted PCF, including the backward vortex Brillouin scattering with planar acoustic wave and forward vortex Brillouin scattering with chiral flexural acoustic wave. These findings on the multi-dimensional Brillouin scattering in the presence of chirality may lead to biophotonic applications on the imaging of biologically chiral structures.



Short Bio: Xinglin Zeng is an associate professor in Russell Centre for Advanced Lightwave Science, Shanghai Institute of Optics and Fine Mechanics and Hangzhou Institute of Optics and Fine Mechanics, China. He received his PhD degree in electronic science and technology from Beijing University of Posts and Telecommunication, China, in 2018. He was also a visiting PhD student in Siddharth Ramachandran's group at Boston University. He did post-doctoral research in the University of Hongkong and Max Planck institute for the science of light with Professors K. Y. Wong and Philip Russell. His research interests include multimode Brillouin scattering, photonic crystal fiber, optical vortices and their applications.

Brillouin Microscopy as a Tool for Probing Mechanics from Tissues to Biomolecular Condensates

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Mechanical cues play a central role in biological function, regulating cell differentiation, driving tissue morphogenesis, and being closely linked to disease progression. Although established modalities such as ultrasound and MRI provide valuable information on tissue mechanics at the macroscopic scale, there is an increasing demand for techniques capable of resolving mechanical properties at cellular and subcellular dimensions. Traditional micromechanical approaches are often limited by a trade-off between invasiveness and throughput, motivating the development of non-contact, label-free methods with micrometer-scale resolution under physiological conditions. Brillouin microscopy (BM) is an emerging optical technique that enables non-invasive, contactless probing of mechanical properties at submicron scales. This presentation will highlight recent applications of BM in biological systems across multiple length scales—from tissues and single cells to biomolecular condensates—illustrating its potential to advance our understanding of the mechanics of living systems.



Short Bio: Li Zhang received her PhD degree in Photonics from École Polytechnique Fédérale de Lausanne, Switzerland in 2020. She continued to work in the Group of Fiber Optics (GFO) as a postdoc until 2023. During her stay in GFO, her study was focused on distributed fiber sensing based on Rayleigh and Brillouin scattering. Since 2023, Dr. Li Zhang has been working as a postdoc in the Center for Life Nano- & Neuro-Science in Istituto Italiano di Tecnologia, Rome, Italy. Her current research interest is on the advancement of the implementation and application of Brillouin microscopy.

Multimodal wearable optical analyzers of microcirculatory-tissue systems of the human body

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Recently, researchers worldwide have increasingly focused on studying the functioning of the microcirculatory-tissue systems (MTS) of the human body due to their involvement in vital processes of the human body, and therefore the possibility of detecting various pathological conditions at earlier stages. Miniaturization of diagnostic devices for wearable use is leading to wider adoption of biophotonics technologies. Here, we present the design features of multimodal wearable analyzers with a justification of the medical and technical requirements imposed on them and examples of their successful application in various diagnostic tasks. Adapted technical requirements for laser Doppler flowmetry (LDF) and fluorescence spectroscopy (FS) channels allow achieving probing depths of more than 2 mm (deep vascular plexus) for the LDF channel and about 0.5 mm for the FS channel. The design features of the analyzers allow recording the blood microcirculation index (perfusion) and the NADH fluorescence intensity with lower sensitivity to motion artifacts, a larger diagnostic volume, and the same variability of measurement results compared to stationary devices.



Short Bio: Andrey Dunaev received the M.Sc., Ph.D. and DSc degrees from Orel State University, Orel, Russia. He is currently a head of the R&D Center of Biomedical Photonics at Orel State University. He is also an Honorary Worker of Science and High Technologies with Russian Federation. He is an author and co-author of more than 200 papers in peer-reviewed journals and conference proceedings, 8 monographs and more than 20 patents. His research interests include multimodal optical diagnostics of microcirculatory-tissue systems, focusing on methodological and metrological support of diagnostic systems. He is also a Senior Member of SPIE.

From Surgery to Behavior: Low-Coherence Biophotonics for Brain Imaging

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This talk highlights recent advances in low-coherence biophotonics for brain imaging across clinical and basic research settings. We focus on two applications: (1) intraoperative assessment of brain cancer infiltration and (2) real-time imaging of neural activity in freely behaving rodents. In the clinical setting, we developed a noninvasive, color-coded quantitative optical coherence tomography (qOCT) technique that provides neurosurgeons with real-time visual guidance to maximize tumor resection while preserving healthy tissue. Results from over 60 patients demonstrate high diagnostic performance, with specificity and sensitivity $\geq 94\%$. In parallel, for basic neuroscience, we developed the first all-fiber, head-mounted two-photon fiberscopy platform. This ultracompact (~ 2.4 mm diameter, < 1 g) system enables high-resolution, large-field-of-view (~ 500 μm) imaging of neuronal activity in freely moving mice. These approaches demonstrate the potential of low-coherence optical methods for real-time, *in vivo* “optical histology”, bridging intraoperative guidance and functional brain imaging.



Short Bio: Xingde Li, PhD, is a Professor of Biomedical Engineering, Electrical and Computer Engineering, and Oncology at Johns Hopkins University. After earning his PhD in Physics from UPenn and completing postdoctoral training at MIT, he joined the University of Washington in 2001. His research focuses on advancing biophotonics imaging for translational and fundamental applications. He has been actively engaged in the scientific community, serving on many professional society committees, chairing multiple international conferences, and holding several editorial roles, including *Light: Science and Applications* and the lead Founding Editor-in-Chief of *BMEF* (a Science Partner Journal). He is a Fellow of OPTICA, SPIE, and AIMBE.

High-throughput stitching-free whole slide imaging system via Fourier ptychographic microscopy and its applications in hemopathy

State Key Laboratory of Transient Optics and Photonics, Xi'an Institute of Optics and Precision Mechanics (XIOPM), Chinese Academy of Sciences (CAS)

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Whole slide imaging (WSI) is indispensable for modern clinical diagnosis and research, but conventional systems are limited by stitching artifacts, narrow depth of field, and the trade-off between resolution and field of view (FOV). Fourier ptychographic microscopy (FPM), a cutting-edge computational imaging technique, breaks these bottlenecks by combining synthetic aperture imaging and phase retrieval, enabling high-resolution, large-FOV imaging without stitching. This report focuses on the design, optimization and clinical application of an FPM-based high-throughput stitching-free WSI system: optimized optical configuration and improved reconstruction algorithms eliminate stitching artifacts and ensure high throughput, with excellent performance in FOV, resolution, imaging speed and compatibility with common hematological staining methods. Finally, the report discusses the system's challenges and future trends, aiming to provide new technical ideas for hemopathy diagnosis and promote the integration of computational optics and clinical hematology.



Short Bio: An Pan is an associate professor and a principal investigator at Xi'an Institute of Optics and Precision Mechanics (XIOPM), Chinese Academy of Sciences, China (www.piclaboratory.com). He focuses on the computational optical imaging and biophotonics area. He is selected as the 2024 Optica Ambassador and is the winner of the 2021 Excellent Doctoral Dissertation of CAS, 2019 OSA Boris P. Stoicheff Memorial Scholarship, the 1st Place Poster Award of the 69th Lindau Nobel Laureate Meetings in Germany (Lindau Scholar). He is the early career member of Optica and SPIE.

Multimodal Computational 3D Imaging on Glossy and Specular Surfaces

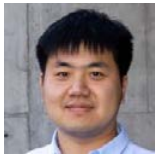
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High accuracy and practicality are both essential for modern 3D imaging, especially in emerging applications such as surgical navigation, wound assessment and in-situ industrial inspection. However, these two goals are often difficult to achieve simultaneously. Existing methods are mainly developed within two research communities. Optical metrology approaches provide high accuracy, but often sacrifice practicality by requiring complex system configurations. In contrast, computer vision methods are more flexible and easier to deploy, but often at the cost of reduced accuracy.

Our work aims to bridge this gap by developing a series of new multimodal 3D imaging principles that integrate complementary strengths from both fields. Unlike conventional multimodal approaches that require multiple sensors, this research track explores unified frameworks that extract multiple modalities from a single imaging system, enabling both high accuracy and practical usability without sacrificing system simplicity. These advances provide a pathway toward deploying metrology-grade 3D imaging in real challenge environments.



Short Bio: Jiazhang Wang is a Postdoctoral Researcher at the Wyant College of Optical Sciences, University of Arizona. He received his Ph.D. degree from Northwestern University.

His research lies at the intersection of optical metrology, 3D vision, and computational imaging, with the focus on developing high-precision and practical 3D sensing systems capable of operating in complex and challenging environments. His work has been published in leading journals, including Nature Communications, Optica, and IEEE Transactions on Computational Imaging. He has received Best Paper Awards or Finalist at major international conferences, including the International Conference on Optics-Photonics Design & Fabrication, OPTICA Imaging and Applied Optics Congress, and OPTICA Frontiers in Optics. He has delivered invited talks at leading computational imaging and optics conferences such as the IEEE Asilomar Conference on Signals, Systems, and Computers, IS&T Electronic Imaging, and Optica Frontiers in Optics (upcoming). His research has also been featured in media outlets including Phys.org, ScienceDaily, SPIE Newsroom, and Optics.org.

Track 8: Luminescence and Applications

Designing Light at the Atomic Scale: The Chemistry of Lanthanide Nanomaterials

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Lanthanide-doped nanocrystals offer a platform for designing light at the atomic scale, where optical behavior is dictated by the discrete 4f energy levels and their interactions within engineered host lattices. Precise control over composition, dopant distribution, and local coordination enables programmable photon management, including upconversion, downconversion, and persistent luminescence. These features provide photostable, multi-wavelength emission with efficient near-infrared excitation, well suited for biological applications. Recent advances in synthetic chemistry and surface engineering have enabled fine control of energy transfer pathways and nanoscale architecture, expanding functionality in imaging, sensing, and light-mediated biological modulation. In parallel, we are developing AI-assisted rare-earth databases to map structure–property relationships and accelerate the discovery of optimized compositions and architectures.



Short Bio: Xiaogang Liu is a Distinguished Professor at the National University of Singapore (NUS). He obtained his Ph.D. from Northwestern University, USA, in 2004, and subsequently carried out postdoctoral research in the Department of Materials Science and Engineering at MIT. He joined the faculty at NUS in 2006 and was promoted to Full Professor in 2017. His research spans several areas of materials chemistry and nanoscience, with particular emphasis on energy transfer processes in lanthanide-doped nanomaterials, optical nanomaterials for neuromodulation and light-field imaging, advanced scintillators for X-ray imaging, and the design of electronic tools for assistive technologies.

Rare Earth ions 4f Electron Upconversion: Manipulation and Applications

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Rare Earth ions 4f Electron Upconversion exhibits advantages such as abundant infrared transitions, broad spectral range, and high resistance, offering irreplaceable advantages in infrared detection, information encryption, and other fields. As a result, it has been widely applied in areas including quantum storage, bioimaging, and information encryption. However, due to the fact that rare earth upconversion luminescence originates from ionic transitions and is subject to forbidden transition effects, rare earth ions suffer from long luminescence lifetimes, limited excitation ranges, and low quantum yields, which severely restrict their practical applications. To address these challenges, we focus on the development, manipulation, and application of rare earth upconversion luminescent materials based on 4f electrons. We have developed novel high-efficiency rare earth upconversion luminescent materials based on sulfides and oxides, proposed a cascade pumping upconversion luminescence approach, achieved an improvement in upconversion luminescence intensity by three to four orders of magnitude, successfully extended the excitation wavelength to 2100 nm, and developed novel upconversion-based encryption and gas sensor devices.



Short Bio: Dr. Bin Dong is currently a Changjiang Scholar Distinguished Professor at Dalian Minzu University. His research focuses on the optical physical properties of rare-earth luminescent materials and their applications. As a corresponding and first author, he has published over 150 peer-reviewed articles in high-impact journals, including Nature Communications, Science Advances, Advanced Materials, Light: Science & Applications, and others. His work has garnered over 13,000 citations.

Lanthanide-based materials and optoelectronic devices

Jilin University, China

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To meet the demands of next-generation optoelectronic devices with low loss and high integration, multiscale design and performance optimization of the lanthanide optoelectronic materials are urgently needed. The speaker focuses on atomic-scale modulation, enabling highly tailored material synthesis and performance customization, thereby facilitating device miniaturization and integration. This presentation will cover: 1) Multiscale atomic-level synthesis and hierarchical structural engineering of lanthanide optoelectronic materials, proposing molecular design and growth/assembly dynamics modulation to achieve atomic-scale interface modification; 2) Atomic-scale structure-property relationships and performance regulation mechanisms, revealing how single-molecule/atomic-level structural vibrations, symmetry breaking, and anisotropy influence energy-level distribution, polarization orientation, radiative transitions, and other electronic states; 3) Energy transfer and loss mechanisms in lanthanide optoelectronic materials and devices, clarifying dipole transition direction and defect distribution, affect the performance of optical and optoelectronic devices.



Short Bio: Xue Bai is a Professor at State Key Laboratory of Integrated Optoelectronics, College of Electronic Science and Engineering, Jilin University, China. She received her PhD degree in condensed matter physics from Changchun Institute of Optics. Fine Mechanics and Physics, Chinese Academy of Science in 2008. Her research interests focus on lanthanide-based nanomaterials and optoelectronic devices. She has published more than 180 SCI index papers with more than 13000 citations in the international journals such as Nature Comm., Nano Lett.. The current h-index value is 65 according to ISI search report. In 2023, she was awarded the National Science Fund for Distinguished Young Scholars in China.

Metal Halide Perovskite Arrays and Artificial Vision Imaging Devices

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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/m^2 , 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.



Short Bio: Professor Caofeng Pan is a distinguished Professor at Beihang University (BUAA), Doctoral Supervisor, and awardee of the Pan 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.

Prof. Pan's 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.

Oxide-Based Optoelectronic Memristive Materials and Bionic Vision Devices

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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.



Short Bio: 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. degree from Northeast Normal University. He carried out postdoctoral work at Politecnico di Milano. He has held the topic editor and editorial board member of the journal *Frontiers in Neuroscience and Nanomaterials*. 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.*. He won National Natural Science Award (second class) in 2019.

Structure Design and Luminescence Tuning for Stimulus-Responsive Luminescent Materials

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To achieve the application of rare earth luminescent materials in multi-dimensional functional sensing and artificial intelligence fields, the luminescent response characteristics of the materials to external stimulus (such as pressure, solvent, and temperature) are of vital importance. How to realize the regulation of photonic dynamics through the evolution of crystal/electronic structure induced by external stimulation is a key scientific issue. Here, we designed a series of new material systems with tunable luminescence under pressure, solvent and temperature stimulus, expanding their application scenarios in multi-field sensing, artificial intelligence and other fields. Firstly, we synthesized a new system of mechanoluminescence materials including $\text{LiTaO}_3:\text{Tb}^{3+}$ and $\text{NaTaO}_3:\text{Pr}^{3+}$ that achieves low deformation detection limit as low as 0.01%. Secondly, we designed a series of organic-inorganic hybrid such as $(\text{Me}_3\text{BzN})_3\text{Sb}_2\text{Cl}_9$ that reveals quadruple/triple-mode luminescence switch with rapid response time (<1 s) and excellent recyclability (≥ 100 cycles) when triggered by moderately-polar and strongly-polar solvents. Thirdly, $\text{Zn}_{0.8}\text{Cd}_{0.2}\text{S}:\text{Ga}$ phosphors were developed with strong and continuous thermal response over an ultrabroad temperature range (-193°C to 200°C). As a result, we proposed the strategy that involves designing and screening stimulus-responsive luminescent materials, effectively promoting the development of new materials, enhancing the sensitivity and cycle stability of the luminescence response of devices.



Short Bio: Guogang Li received his PhD degree in Inorganic Chemistry from Changchun Institute of Applied Chemistry Chinese Academy of Sciences. He is a professor of China University of Geosciences.

Tailoring Trap Depths in Luminescent Materials for Emerging Applications

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Our group has pursued systematic trap design and modulation in inorganic persistent luminescence (PersL) materials since 2013,. Two design principles, namely band structure engineering and trap level engineering were proposed, leading to the successful development of a series of novel inorganic materials featuring designable trap architectures and continuously tunable trap depths. The material platform was further expanded from (oxy)nitrides to other complex anion compounds, yielding a family of deep-trap long-persistent materials covering the visible to near-infrared spectral region. Building on these deep-trap materials, the team introduced a new paradigm of multi-dimensional optical information recording that simultaneously employs light intensity, wavelength, and lifetime as independent information dimensions, thereby surpassing the density limit of conventional optical storage. More recently, inspired by the host–dopant strategy in inorganic luminescence, we constructed a host–guest system in organic materials and verified the existence of traps through thermoluminescence, photocurrent, and transient absorption measurements. By precisely tuning the guest LUMO energy levels at the molecular scale, continuous modulation of trap depth was achieved. The resulting organic PersL materials exhibit emission lasting for hours, with charge carrier retention extended to several weeks. These findings are expected to offer valuable insights toward establishing universal design principles shared across inorganic and organic luminescent materials.



Short Bio: Yixi Zhuang received his PhD degree in Materials Science and Engineering from Kyoto University, Japan. He is now a professor of Xiamen University, China.

Study on Novel Semiconductor Photodetection Materials and Devices and Their Application

Jilin University, China

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To address the key bottlenecks of traditional semiconductor detectors in terms of sensitivity, stability, and cost control, this paper presents systematic and in-depth innovative research. Following the main line of "high-quality materials, high-performance devices, multi-scenario applications", and through strategies such as lattice and surface/interface defect engineering, we have successfully overcome the core challenges of lead halide compound semiconductors regarding carrier transport, defect suppression, and environmental stability. A complete technical route from material preparation and device fabrication to application systems has been established. On this basis, a novel detector material system with independent intellectual property rights has been developed, synergistically improving detection sensitivity, response speed, and operational stability. Furthermore, intelligent application pathways for multi-scenario uses, including medical imaging and radiation safety monitoring, have been explored.



Short Bio: Liang Shen received his PhD degree in Microelectronics and Solid-State Electronics from Jilin University. He is a professor of Jilin University, China. He is vice dean of the college of electronic science and engineering. He primarily engaged in research on new semiconductor optoelectronic information materials, devices, and systems

Rational Charge-Transfer Modulation for Narrowband Blue Thermally Activated Delayed Fluorophores

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Multi-resonance thermally activated delayed fluorescence (MR-TADF) emitters are attractive for ultrahigh-definition organic light-emitting diode (OLED) displays due to their narrowband emission and high color purity. However, the detrimental trade-off between electroluminescence efficiency and broadened emission band remains a critical challenge for blue MR-TADF materials. Herein, a rational charge-transfer engineering strategy is proposed to design and synthesize MR-TADF molecules. Benefiting from the precise charge-transfer regulation for rapid spin-flip process, the molecules achieve a high reverse intersystem crossing rate constant, narrow full width at half maximum, and high horizontal dipole orientation ratio. The optimized blue OLED emitter exhibits a high external quantum efficiency over 40% with mitigated efficiency roll-off at high luminance. The present study breaks through the “efficiency-purity” trade-off dilemma, providing new insights and practical examples for the design of high-efficiency, low-roll-off narrowband blue OLED materials.



Short Bio: Jianxin Tang received his B.Sc. degree in physics from Zhejiang University in 2002, and Ph.D. degree in Physics and Materials Science from City University of Hong Kong in 2006. In 2008, he was appointed professor at Soochow University. In 2021, he was appointed professor at Macau University of Science and Technology. His current research areas/interests span device physics and surface science on organic and perovskite light-emitting diodes technology for flat panel display and solid-state lighting, and organic/perovskite photovoltaic cells for renewable energy. He has published over 300 papers in internationally refereed journals in the field of device physics and optoelectronics. He has also served as a chairman/organizing committee member of over 30 international/domestic conferences.

Semiconductor Quantum Dot Luminescence and X-ray Detection

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This report summarizes our progress in semiconductor quantum dot (QD) based X-ray scintillators, focusing on luminescence mechanism elucidation, material design, and imaging applications. Using ZnO QDs as a model system, we revealed a mixed-state emission mechanism of self-trapped excitons (STEs) and proposed a “deviatoric stress-induced STE transition” enabling controlled modulation of STE emission states. Guided by these insights, we developed a disorder-assembled meter-scale transparent QD scintillator with 96% transparency and 42 lp/mm imaging resolution, as well as a 2 g/cm³ water-soluble liquid scintillator with 6600 photons/MeV and a record 27 lp/mm resolution for liquid systems. We further demonstrated ultrafast CdSe/ZnS QD scintillators with nanosecond response, 54,649 photons/MeV light yield, and 44 lp/mm resolution, enabling high-resolution dynamic imaging. In parallel, heavy-atom-doped carbon nanodot scintillators achieved 42,058 photons/MeV and high-contrast imaging of soft biological tissues. Finally, we established a X-ray detection platform integrating material synthesis, characterization, and imaging system development.



Short Bio: Kaikai Liu received his PhD degree in Condensed Matter Physics from University of Chinese Academy of Sciences. He is a Professor at Zhengzhou University and a recipient of the Young Changjiang Scholar (2023). His research focuses on carbon nanodots, QDs, triplet exciton luminescence, phosphorescence, and advanced X-ray scintillators. He has published more than 50 papers as first or corresponding author in Nature Communications, Advanced Materials, Light: Science & Applications, and so on. His work aims to uncover the photophysical mechanisms of low-dimensional luminescent materials and develop high-performance optical and radiation detection systems for bioimaging, sensing, and X-ray imaging applications.

Self-recovery Mechanoluminescence of Magnesium and Aluminum Based Smart Oxides

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In this study, we report on the self-recovery mechanoluminescence observed in smart oxides of magnesium and aluminum, which is finely tuned through temperature modulation, co-doping strategies, heterogeneous modulation, and molten salt-assisted techniques. Our investigation reveals that temperature plays a crucial role in the creation of high-luminosity near-infrared mechanoluminescent magnesium oxide (MgO) and aluminum oxide (Al₂O₃) samples. Through precise optimization of dopant concentrations, annealing parameters, and co-doping methodologies, enhancements in emission intensity, spectral tunability, and significant cyclic stability have been achieved. The molten salt-assisted technique has been innovatively utilized to produce nanosheet single crystals, demonstrating exceptional mechanoluminescent film-forming properties. This technique provides a smooth and flat surface that facilitates micro-stress application and the deposition of coatings with superior adhesion. By employing both physical and chemical control methodologies, we have successfully achieved stress-emitting structures with uniform spherical, one-dimensional fiber morphology, and various shapes. Utilizing the developed materials, a multitude of applications could be developed for advanced lighting-imaging, optical communications, and stress sensing, among others.



Short Bio: Dengfeng Peng received Ph.D. degree (2013) in Materials Science and Engineering from Tongji University. He spent one year as a joint Ph.D. student at AIST in Japan(2012). He carried out postdoctoral research work at City University of Hong Kong (2013), Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences (2015), and The Hong Kong Polytechnic University (2016). He is now a professor in College of Physics and Optoelectronic Engineering at Shenzhen University.

Molecular Engineering for Organic Mechanoluminescence

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Mechanoluminescence (ML), also known as triboluminescence, is a phenomenon in which visible or ultraviolet (UV) light is emitted from a material upon mechanical actions such as friction, collision, peeling, or fracture. The great potential of ML in stress sensing, pressure-responsive lighting, advanced anti-counterfeiting marking, material damage monitoring, and emerging biomedical applications has led to increasing research interest. In the field of organic luminescent materials, researchers have long been dedicated to exploring molecular engineering strategies, leading to the successful design of various organic ML materials with diverse and tunable functionalities. Representative achievements based on molecular engineering include: reversible switching of ML by turning UV light on and off; efficient near-infrared mechanophosphorescence via host-guest doping; dual-channel mechanophosphorescence realized through highly distorted molecular frameworks; and solar-blind UV ML achieved by controlled molecular packing. These studies not only provide innovative insights for practical ML applications but also highlight the critical role of molecular engineering in advancing organic ML materials.

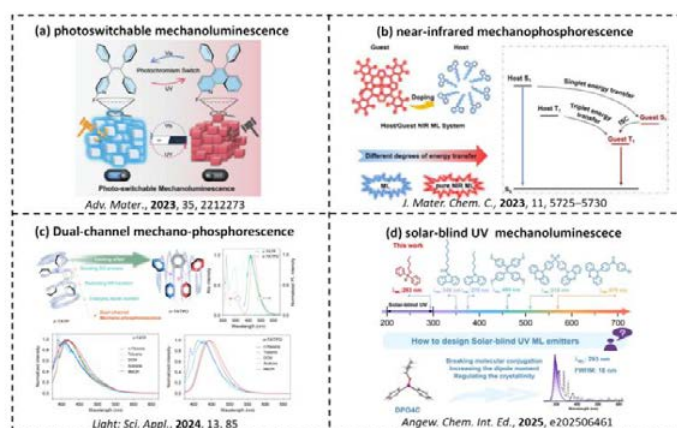


Figure 1. The organic mechanoluminescent materials



Short Bio: Tao Yu is a professor at the Institute of Flexible Electronics, Northwestern Polytechnical University, China, and a director of the Flexible Electronics Engineering Center in Xi'an. He has made contributions as the National Young Talents in the field of sensing organic optoelectronic materials and smart packaging. As corresponding author, he has published more than 50 high-level papers such as Nat. Commun., J. Am. Chem. Soc., Adv. Mater., Angew. Chem. Int.

Ed., Light: Sci. Appl., Adv. Funct. Mater., Chem. Sci., Research, including 7 ESI highly cited papers, 1 V.I.P. paper. He has successively led 13 national and provincial project, deeply exploring the translation of sensing optoelectronic materials into practical applications.

Dye-coupled lanthanide nanocrystals for advanced optical biosensing and photodynamic therapy

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The unique optical properties of lanthanide-doped inorganic nanocrystals make them promising candidates for a variety of applications, including light energy harvesting, emission, biosensing, therapeutics, and photocatalysis. Surface modification with organic dye molecules offers a powerful strategy to fine-tune these properties, enabling the discovery of novel optical phenomena within organic-inorganic composite systems. Developing highly efficient lanthanide-based nanoconjugates addresses limitations of traditional nanomaterials, paving the way for enhanced functionality in emerging applications. In our recent work, we focus on the fabrication and mechanistic exploration of lanthanide nanocrystals featuring unique lattice structures and core-shell architectures. By investigating energy transfer processes at the nanocrystal surface, we aim to optimize these materials for use in nanotherapeutics. This presentation highlights our advancements in dye-coupled lanthanide nanomaterials, emphasizing excitation dynamics modulation and their transformative potential in diverse applications.



Short Bio: Renren Deng is a professor at the School of Materials Science and Engineering, Zhejiang University. His research focuses on developing luminescent nanomaterials for applications in photovoltaics and biomedicine and understanding energy transfer through organic molecule-inorganic nanocrystal hybrid systems. Dr. Deng has published over 40 peer-reviewed papers in a range of prestigious journals including Nature, Nature Nanotechnology with 11,000+ combined citations. He has several awards including 2021 NSFC

Excellent Young Scholars, and 2022 DPC's Sturge Prize.

Ultralong Organic Phosphorescence

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Organic phosphorescence is defined as a radiative transition between the different spin multiplicities of an organic molecule after excitation, here we refer to the photo-excitation. It exhibits a long emission lifetime ($\sim\mu\text{s}$), large Stokes shift and rich excited state properties, attracting considerable attention in organic electronics during the past years. Ultralong organic phosphorescence (UOP), a type of persistent luminescence in organic phosphors, typically demonstrates an emission lifetime exceeding 100 milliseconds, which is generally considered the resolution limit of the naked eye. Because of the inherent spin-forbidden transition and the fast-non-radiative decay rate of triplet excitons, it is a fundamental challenge to achieve efficient organic phosphorescence from metal-free organic materials under ambient conditions. In the past years, we focused on the UOP, from materials to applications. We have proposed effective strategies, such as intermolecular repulsive interaction and stereo-hindrance engineering, to improve the phosphorescence quantum efficiency and prolong the emission lifetime. By constructing the multiple-emitting centers to regulate the isolated-molecular and aggregated-state phosphorescence, we have achieved the color-tunable organic phosphorescence. These smart-responsive phosphors have been applied in visible UV light detection. Moreover, we have reported the organic phosphorescence scintillators with bright triplet exciton harvesting to enhance radioluminescence. These organic scintillators demonstrated potential application in X-ray radiography.



Short Bio: Shi Huifang received her PhD in 2013 from Nanjing University of Posts and Telecommunications in China, under the guidance of Professor Wei Huang. Following her graduation, she served as a postdoctoral research fellow under Professor Yanli Zhao at Nanyang Technological University. In 2016, she joined Nanjing Tech University and promoted as a full professor in 2021. She was selected as MOE Young Changjiang Scholar in 2024. Her current research focuses on metal-free organic phosphorescence and scintillators. Over the years, she has published over 80 academic papers in high-impact journals, including *Nature Photonics*, *Nature Communications*, *Light: Science & Applications*, *Advanced Materials*, and so on. Among these, 15 papers are recognized as ESI Highly Cited Papers, with total citation over 13,000 times. Her H-index stands at 55.

Photonic glass and applications

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The regulation of micro/nano-scale structures and photonic functions serves as a critical foundation for the development of novel glasses and their new applications. A new mechanism for glass structure regulation has been proposed. We developed three-dimensional micro/nano-photonic structures with broadly tunable photoluminescence, and the development of miniaturized light-emitting devices such as glass-based micro-LEDs. Furthermore, a novel approach has been advanced to reduce the threshold for structural regulation through glass network design, enabling low-energy and rapid modification of glass structures. This facilitated the construction of novel hierarchical heterogeneous structures, specifically nanocrystals@amorphous-nanoparticle@glass composites, within which continuous-wave excited random lasing emission was discovered. Additionally, a deep learning-driven optical field manipulation method was developed to enhance the precision and efficiency of glass structural regulation, enabling the fabrication of low-loss three-dimensional optical waveguides and photonic interconnects.



Short Bio: San Zhang received his PhD degree in Department of Materials Science Engineering from Zhejiang University. He is a professor of Zhejiang University, China and recipient of national-level high-ranking young talent program. He is awarded multiple honors including top 10 Chinese scientific advances, the top 10 Chinese optical advances, and the Youth Science and Technology Award from the Chinese Ceramic Society. He has published over 60 first/corresponding-author papers in high-impact journals such as Science, Science Advances, Nature Communications, Advanced Materials, and Light: Science & Applications.

Manipulating Ionic Defects in Quantum Dot Optoelectronic Devices

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Quantum dots (QDs) have emerged as a promising candidate for next-generation displays due to their advantages of high color purity, wide spectral tuning range, and high conversion efficiency. Yet it faces two key challenges: (1) QDs have small sizes, high specific surface areas, and numerous surface dangling bonds, making them prone to ion defect generation; (2) In QD devices, defects can easily induce ion migration, leading to trap state generation and altering emission centers, thereby affecting color purity. It is necessary to establish a failure analysis mechanism for devices to facilitate the design of higher-quality devices. This report will focus on our work regarding the regulation and understanding of QD defects and their application in model devices. It will highlight the suppression of trap state generation using the differences in localized orbital characteristics of multi-anion soft anions to achieve high-efficiency, long-lifetime QLEDs, as well as the construction of ion-controllable migration brain-like devices through various defect regulation methods. We are committed to understanding the generation, modulation, and dynamic behavior under electric fields of defects in QDs, contributing to the development of next-generation QD devices.



Short Bio: Jiaqi Zhang received his PhD degree in Materials Science from Imperial College London. He is a professor of Jilin University, China. Dr. Zhang's research interest is semiconductor optoelectronic materials and device physics., focusing on the anion defect-dominated dynamic evolution behavior and chemical state control of emerging inorganic semiconductors.

Electric-Field Topology and Confined Exciton Dynamics in Ultrahigh-Resolution QLEDs

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Ultrahigh-resolution quantum-dot light-emitting diodes (URQLEDs) are pivotal for next-generation near-eye displays, yet they face severe efficiency degradation when scaled to submicron dimensions. This report presents a systematic strategy to overcome these limits through synergistic nanofabrication and excitonic management. First, we introduce a sacrificial-layer-assisted hard nanoimprint and monolithic transfer printing strategy. This approach achieves "template-limited replication" with >99.9% structural fidelity, enabling deterministic RGB patterning up to 25,400 PPI with transfer yields exceeding 99.99%. We reveal that dielectric discontinuity at the nanoscale reshapes the electric-field topology, causing edge-field concentration. By implementing dielectric-field engineering with TiO₂ nanoparticles, we homogenized the internal field, achieving red URQLEDs with a record 26.1% EQE and lifetimes exceeding 65,000 h at 12,700 PPI. Complementary to these structural advances, we investigate exciton dynamics under geometric confinement. We demonstrate that the confined microhole architecture enhances dipole–dipole coupling, enlarging the Förster radius from 4.9 to 9.2 nm. This mechanism facilitates highly efficient energy transfer, allowing submicron devices to suppress non-radiative recombination and bypass the traditional "efficiency droop." Together, these findings provide a new paradigm for excitonic and electric-field engineering in nanoscale optoelectronic systems.



Short Bio: Lihua Lin received his Ph.D. degree in Condensed Matter Physics from Nanjing University. He is a Fujian Province High-Level Talent at Fuzhou University, where his research focuses on ultrahigh-resolution QLEDs and semiconductor device physics. He has published seven first-author papers in leading journals, including *Nature* and *Advanced Functional Materials*, and developed independent intellectual property in ultrahigh-resolution QLED technologies.

High-Efficiency Rare Earth Luminescent Materials for Marine Applications: Design, Preparation, and Exploration

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Luminescent materials show great promise for marine applications, yet the complex marine environment often causes severe luminosity degradation, spectral drift, and reduced stability. To address these challenges, we systematically investigated local structure modulation, energy-level engineering, and defect/interface control. This report presents our work on the design and preparation of high-efficiency rare-earth luminescent materials, along with preliminary results on their marine applications. First, we regulated interfacial structures to construct single-particle heterogeneous interfaces, which spatially isolated luminescent centers and passivated defects, boosting the external quantum efficiency (EQE) of full-spectrum materials to 56.2%. Second, we reconstructed local structures via heterovalent substitution to create multiple lattice sites, enabling ultra-broadband continuous emission (375–760 nm) from a single activator with a full width at half maximum (FWHM) of 330 nm. Third, we engineered defects and traps to establish a charge-compensation–trap synergistic model, yielding materials with excellent thermal stability between 298 and 573 K and stable multi-modal responses in radioluminescence and afterglow emission. Building on these materials, we explored their potential in marine ecological lighting (fishing and navigation lights), optical detection (rapid identification of dyes and liquids), and structural health monitoring (stress sensing and early warning), laying the groundwork for next-generation luminescent materials designed specifically for marine environments.



Short Bio: Lei Zhou is an Associate Professor at the School of Chemical Engineering and Technology, Sun Yat-sen University, recruited via the University’s “Hundred Talents Program” and recipient of the 2023 Pearl River Scholarship. He earned his PhD in Inorganic Chemistry from Sun Yat-sen University, then conducted postdoctoral research at SYSU with Prof. Mingmei Wu and the National University of Singapore with Prof. Xiaogang Liu (Academician of the Singapore Academy of Sciences). Leading 5 projects (including NSFC grants), he has published over 60 SCI papers in top journals like *Adv. Mater.* and *Angew. Chem. Int. Ed.*, with >3,000 citations, an H-index of 28, and 4 authorized invention patents.

Track 9: Light-responsive Polymers and Applications

Liquid Crystal Networks: A Unique Materials Platform for Optics, Haptics and Soft Robotics

Eindhoven University of Technology

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Since their inception in the 1980s, reactive mesogens (RMs) have evolved into a versatile class of soft matter materials with applications spanning optics, mechanics, and adaptive surfaces. Initially, they were developed to enhance display optics, where their large, temperature-stable, and tunable birefringence enabled functionalities such as viewing-angle control and light-effective polarization filters. In parallel, they have emerged as a promising materials platform for soft robotics. When stimulated by light, these polymers undergo controlled changes in shape, surface topography, and porosity. Thin films can be programmed to transform from planar geometries into complex, pre-designed three-dimensional shapes, enabling concepts such as light-driven origami and self-folding structures. Additionally, we explore coatings that reversibly switch between flat and corrugated states with predefined surface topographies. The lecture will devote particular emphasis on soft robotics and haptic applications.



Short Bio: Dirk J. Broer is polymer chemist specialized in molecular order, structuring and self-organization. In 1973, he joined Philips Research, Eindhoven, Netherlands where he developed the liquid crystal network technology which led to his PhD degree at Groningen University in 1990. From 2003 to 2010 he was senior research fellow and vice president at Philips Research. He was appointed in 1996 as part-time professor at Eindhoven University of Technology and in 2010 as fulltime professor to chair the Department Functional Organic

Materials and Devices expanding further his research on adaptive materials. He is member of the Royal Dutch Academy of Sciences.

From light beams to materials dreams: Tuning polymer functions with photons

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Light-responsive polymers provide a powerful platform for designing materials that are adaptive, functional, and sustainable. This presentation explores how light can be used as a clean and precise energy source to control polymer properties, from reversible adhesion in azobenzene-functionalized polysiloxanes to reconfigurable conductivity and switching behavior in viologen–siloxane nanostructures. It also introduces a fully light-driven closed-loop recycling strategy, in which polypinacols are photopolymerized and depolymerized back to their monomers under visible light using an earth-abundant photocatalyst. Together, these examples demonstrate how photochemistry can enable circular material lifecycles and multifunctional polymer systems for future sustainable technologies.



Short Bio: Fabian Eisenreich received his PhD in Chemistry from the Humboldt University Berlin, Germany, under the supervision of Prof. Stefan Hecht. After a research stay with Prof. Craig Hawker at the University of California, Santa Barbara, he carried out his postdoctoral research with Prof. Bert Meijer at Eindhoven University of Technology in the Netherlands. Since 2022, he has been an Assistant Professor at Eindhoven

University of Technology, where he leads a research group focused on photoresponsive and sustainable polymers.

Programmed light-responsive topographical deformations in liquid crystal polymers

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Surface topographies refer to micro- and nanoscale textures formed at the outermost layer of a coating, which play a crucial role in modern technologies by providing adaptable surface properties. To create dynamic surface topographies, we use liquid crystal polymers (LCPs). In LCPs, the mesogenic units are anisotropically aligned. This molecular alignment can be spatially organized through photoalignment techniques widely used in liquid crystal display technologies. LCPs are intrinsically sensitive to temperature changes, and we further advance this system to light-responsive coatings by incorporating azobenzene moieties. Thermal activation or UV irradiation reduces molecular order of LCPs and thereby induces shape transformations. As a result, an initially flat coating transforms into designed surface structures, forming elevations or depressions depending on the local alignment design. The resulting topographies exhibit diverse textures, and large amplitudes. After cooling or blue-light irradiation, the surface structures are erased, restoring the coating to its initial flat state. These reversible photoresponsive surfaces offer adaptive interfaces for haptic feedback, controlled cell growth, and systems with tunable adhesion and friction.



Short Bio: Yuxin You received her PhD degree from Eindhoven University of Technology in the Netherlands. She is currently an Assistant Professor at South China Normal University in China.

Liquid Crystal for Smart Windows

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Smart switchable windows for buildings and vehicles become more and more important because they can provide daylighting, offer comfortable environment, control privacy and reduce energy consumption. Liquid crystals have been played an important role in the development of smart windows, because they can be produced in thin flat panel form or film form and can be reversibly and instantly switched to different optical states by voltage, light and temperature. They exhibit two or more of the following states: optically transparent state, scattering state, absorbing and reflecting state. When a liquid crystal window is in the transparent state, incident light goes through it, and thus it can be seen through. When it is in the scattering state or absorbing state or reflecting state, incident light is scattered or absorbed or reflected, and thus it cannot be seen through, providing privacy and controlling radiant energy flow.

In the presentation we will first review various liquid crystal technologies that can be used for smart windows. Then we will in details discuss polymer stabilized cholesteric texture (PSCT) liquid crystal smart window and bistable cholesteric liquid crystal (BCLC) smart window. PSCT smart window is in a strongly scattering state at 0 V. When a voltage is applied, it is switched to a highly transparent state. It has the advantages of high contrast, high transmittance and large viewing angle. BCLC window has two stable states at 0 V. One state is transparent and the other state is scattering. The window can be switched from the transparent state to the scattering state by a low AC voltage pulse of 0.2 second, and from the scattering state back to the transparent state by a high AC voltage pulse of 0.5 second. Because of the bistability, the window is very energy-saving, and is suitable for architectural windows and vehicle windows.



Short Bio: Deng-Ke Yang is a professor in the School of Emergent Soft Matter at South China University of Technology. He received his B.S. in physics from Tsinghua University in China in 1984 and his Ph.D. in physics from University of Hawaii in 1989. He worked as postdoctoral fellow, assistant professor, associate professor and full professor in Kent State University from 1989 to 2025. His main research interest is in liquid-crystal physics and devices. He has coauthored 2 books and 8 book chapters. He also has published more than 200 papers. He received the Society for Information Display (SID) Special Recognition Award in 2005 for his pioneering work on polymer-stabilized cholesteric devices and reflective displays. He was elected as a fellow of the SID in 2007 for his significant scientific and technological contributions to bistable, reflective cholesteric displays and to polymer-stabilized cholesteric devices, and for his outstanding contributions to education. He received SID Slottow-Owaki Prize in 2017 for his outstanding contributions to the education and training in the field of liquid-crystal displays. He also received Kent State University annual Outstanding Research and Scholarship Award in 2017. He has been named one of the world's top 2% of scientists by Stanford University.

3D reconfigurable photonic systems by liquid crystalline polymers

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Polymer-based photonic platforms offer a powerful combination of low cost, processability, and structural versatility for engineering optical functionalities at the micro- and nanoscale. Recent progress in advanced lithographic and additive manufacturing techniques has enabled the fabrication of complex three-dimensional architectures in functional materials, opening new opportunities for integrating stimuli-responsive systems into photonic devices. In this context, dynamic polymers such as liquid crystalline polymers provide large, reversible, and anisotropic deformations under light or thermal excitation, enabling active control over both geometry and refractive index. This capability allows light to act not only as an information carrier but also as a means to dynamically reconfigure 3Dprinted responsive polymer nanostructures for tunable linear and nonlinear photonics. These systems enable remote and reversible modulation of optical functionalities, including microlasers, beam steering devices, microcavities, and photonic crystals [1]. Beyond conventional photonic applications, spatial and temporal control of optical responses in disordered and structured materials can be exploited for advanced security technologies. In particular, we demonstrate how the reconfiguration properties can enhance the security of all-optical physical unclonable functions (PUFs) [2-4]. Photoresponsive materials are pushing forward the field of integrated polymer photonics and physical cyber security fostering the continuous search of advanced functionalities at low power and high speed. [1] De Bellis, I., Martella, D., et al., *Adv Funct Mater* (2023), 2213162. [2] Donato, S., Nocentini, S., et al., *Small* (2023), 2306802 [3] Nocentini, S., Rührmair, et al., *Nature Materials* (2024), 1. [4] Salvestrini, S. Maestri, F. Et al., *APL Photonics* (2026), 11 (2).



Short Bio: Sara Nocentini is a senior researcher at the National Institute of Metrological Research in the division of "Metrology of innovative materials and life science" and affiliated researcher at the European Laboratory of Nonlinear Spectroscopy in Florence, Italy. Her research activity mainly focuses on the study and characterization of liquid crystalline based polymer at the micro and nanoscale for applications in photonics, cryptography and sensing. She was awarded with a ERC Stg (3DnanoGiant) in 2024 and she is the PI of two national projects. She got her International Doctorate in Atomic and Molecular Photonics at the European Laboratory for Nonlinear Spectroscopy in Florence in 2017. She is author of more than 30 articles in peer-reviewed journals. Part of this research project was financed by the European Union, Horizon ERC Stg 3DnanoGiant (n° 101163799).

Photoinduced properties of PAZO-based systems with molecular and nanoparticle additives: experimental and simulation studies.

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Azobenzene-containing polymers, particularly azopolymers, are versatile photoresponsive materials in which light-driven trans–cis photoisomerization can induce changes from the molecular to the mesoscopic length scale, including molecular reorientation, optical anisotropy, and surface reshaping. Conformational changes and reorientation of the azo group during photoisomerization are macroscopically observed as photoinduced birefringence when thin films are illuminated with polarized light. Under spatially structured illumination, some functionalized azobenzene polymers can also undergo mass transport, leading to surface relief formation, such as the surface relief gratings generated by interference patterns. These coupled phenomena are central to applications in optical storage, holography, surface patterning, photolithography, and photomechanical actuation.

In this talk, I will discuss PAZO-based thin films as a model platform to investigate how molecular and nanostructured additives can be used not only to tune material performance, but also to probe the mechanisms underlying the photoinduced response. Molecular additives such as ethylene glycol modify the free volume of the polymer matrix, providing a route to control birefringence recording, relaxation, and erasure dynamics by optimizing the PAZO/plasticizer ratio. Metallic nanoparticles, in turn, can enhance surface relief grating formation and diffraction efficiency, highlighting the role of local polymer mobility and nanoparticle concentration in light-driven mass transport.

To interpret our experimental results, as well as related observations reported in the literature, I will discuss stochastic Monte Carlo simulations of azopolymer dynamics, which suggest that illumination gradients can induce anomalous, often superdiffusive, polymer chain motion, and offer insight into the role of nanoparticles in mass redistribution. These results demonstrate that additives are not simply passive modifiers of PAZO films, but active tools for probing, controlling, and optimizing photoinduced processes in azopolymer-based materials. Finally, this approach opens new and exciting possibilities for the design of materials for light-driven surface-structuring and optical memory applications.



Short Bio: María Gabriela Capeluto is an Associate Professor in the Department of Physics at the School of Exact and Natural Sciences, University of Buenos Aires (FCEN-UBA), Argentina, and an Independent Researcher at Argentina's National Scientific and Technical Research Council (CONICET). She completed her MSc-equivalent degree and PhD in Physics at the University of Buenos Aires, where her doctoral research focused on nanolithography and high-precision metrology in the extreme ultraviolet. Her current research combines experimental approaches and simulations to study light–matter interaction in complex and nanostructured systems. Her interests include photoinduced processes in photosensitive materials and nanoparticle-based systems, single-photon sources based on quantum emitters coupled to plasmonic nanoantennae, and laser interaction with nanostructured materials at relativistic intensities. She maintains an active international collaboration with Colorado State University, Fort Collins, USA, where she is a Visiting Research Scientist. In addition, she serves as Secretary for the

Promotion of Equity and Gender at FCEN-UBA.

Hidden in plain sight: Information for robots and Augmented Reality invisibly encoded using bioinspired structural color reflectors

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Materials that generate well-defined structural color, i.e., selectively reflect a narrow wavelength band of light by Bragg reflection from an internal periodic structure, are immensely useful across a plethora of contexts. We argue that the most attractive class of structurally colored materials is given by cholesteric liquid crystals, in particular when molded into spherical shells of ~ 100 μm diameter and then polymerized into glassy solids. We call these advanced photonic elements *Cholesteric Spherical Reflectors*, or CSRs. By infusing CSRs with dyes (dCSRs) we benefit from reflection, geometry and absorption acting in synergy, obtaining circularly polarized structural color tunable across the visible spectrum with minimum viewing angle dependence.¹ We demonstrate how dCSRs can be used to camouflage graphical patterns from detection by human eye sight, yet allowing machines like robots or Augmented Reality (AR) devices equipped with low-cost machine vision to detect them with unprecedented clarity, with minimum computational or bandwidth expenses.



Short Bio: Jan Lagerwall (M.Sc. Physics 1997; Ph.D. Materials Science, 2002) is professor in physics at University of Luxembourg. His research focuses on soft matter physics, chemistry and materials science, connecting liquid crystals with many other fields, from fiber spinning and microfluidics to art, architecture, robotics and security. Building on a career in Sweden, USA, Germany and Korea, his research spans from fundamental physics to applications for society and industry via collaborations and the foundation of spin-off companies.

Light-driven liquid crystalline materials for chiroptics and actuation

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Due to their large optical anisotropy and stimuli-responsive characteristics, liquid crystalline materials enable a number of interesting applications. Here I will briefly summarize recent technological progress of liquid crystal materials and devices in our research group, particularly including: 1) cholesteric liquid crystals (CLCs) integrated with a uniform Au clusters (AuCs) film for generation and modulation of circularly polarized luminescence (CPL); and 2) metasurface-enabled liquid crystal elastomer actuators. These works have important applications in the next-generation micro/nanophotonic devices, display and imaging, actuation and soft robotics, et al.



Short Bio: Dr. Yan Jun Liu received his Ph.D. degree in photonics from Nanyang Technological University, Singapore. He is currently a professor of Department of Electrical and Electronic Engineering at Southern University of Science and Technology. His research interests include liquid crystal optics and micro/nano-optics.

Light trained intelligent liquid crystal polymers

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We propose the integration of a haptic liquid crystal polymer network (LCN) coating into optical displays, creating a next-generation touchscreen with dynamic haptic feedback (1). This innovative approach bridges optics and haptics, enabling displays to provide real-time tactile sensations through programmable surface deformations. The LCN coating responds to external stimuli such as temperature, light, and electric fields (2), allowing for localized texture changes, friction modulation, and pressure-sensitive feedback. This seamless integration transforms smooth glass surfaces into interactive, touch-responsive interfaces, enhancing user experience in consumer electronics, augmented reality, and assistive technologies. The ability to create programmable tactile patterns makes it ideal for visually impaired users, immersive gaming, virtual training environments, and advanced medical interfaces. By merging haptics with optics, this technology redefines human-machine interaction, paving the way for smarter, more intuitive touch interfaces in the digital age.



Figure 1 Schematic representation shows the haptic functions.



Short Bio: Danqing Liu received his PhD degree in Mechanical Engineering from Eindhoven University of Technology. She is a associate professor of Eindhoven University of technology; The netherlands.

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Spin engineering in low-dimensional emitters

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Controlling the spin character of excited states provides a powerful route to move beyond conventional approaches to light-emitting device design. In low-dimensional inorganic semiconductors, exchange interactions govern the exciton fine structure splitting and optical activity of bright and dark states. By tailoring structural anisotropy, we demonstrate LEDs with intrinsic linearly polarized electroluminescence, providing a route towards polarization-sensitive photonic devices without relying on external optical structures. In organic semiconductors, we explore strategies to control singlet–triplet population dynamics, suppress slow delayed-emission components, and enhance fast radiative channels. This enables electroluminescence with rapid temporal response, opening opportunities for high-speed optical communication based on OLEDs. These results establish spin engineering as a design strategy for semiconductor emitters with tailored polarization, efficiency, and speed.



Short Bio: Linjie Dai is currently an Assistant Professor at Peking University. Linjie earned his PhD in Physics from University of Cambridge. From 2021 to 2023, he was a postdoc at Cavendish Laboratory. From 2023 to 2025, he was a Marie Curie Fellow at MIT.

Track 10: Light: Sino-Polish Photonics Forum

ICTER: Redefining Ophthalmology through Multidisciplinary Excellence and Global Collaboration

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Visual impairment remains a significant global health burden, necessitating a shift from traditional research silos toward integrated, translational ecosystems. The International Centre for Translational Eye Research (ICTER) was established to meet this challenge by uniting world-class researchers across diverse fields—from physics and engineering to molecular biology and clinical medicine. This talk highlights ICTER's strategic initiatives to develop transformative technologies for the early detection and treatment of eye diseases. We showcase our latest breakthroughs in retinal imaging, genomic research, and the development of intelligent ophthalmic devices. By emphasizing a collaborative framework that brings together academic partners and industry leaders, ICTER aims to establish new standards in vision care and improve patients' quality of life worldwide.



Short Bio: Dr. Karol Karnowski leads the Image-guided Devices for Ophthalmic Care (IDoc) group at the International Centre for Translational Eye Research (ICTER), based at the Institute of Physical Chemistry, Polish Academy of Sciences. His expertise lies in the design and implementation of functional optical imaging tools, with a specific focus on Optical Coherence Tomography (OCT) and image-guided microsurgical devices.

Following a transformative three-year postdoctoral fellowship at the University of Western Australia (OBEL), Dr. Karnowski returned to Poland to spearhead multidisciplinary projects supported by prestigious frameworks, including NAWA and EU H2020. Currently, his research group is at the forefront of merging high-speed OCT imaging with robotics and automation to redefine precision in ophthalmic surgery.

A key focus of his recent work is on intelligent, feedback-driven platforms to support complex interventions, such as the robotic-assisted injection of therapeutic agents into specific ocular tissues.

Towards digital twins of quantitative phase imaging systems in biomedical applications

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Digital twins (DTs) are emerging as powerful computational frameworks for the design, optimization, and validation of a wide range of measurement systems. In this work, we present a first attempt at developing a unified digital twin methodology for a broad class of two-dimensional (2D) and three-dimensional (3D) quantitative phase imaging (QPI) modalities. To support biomedical applications of QPI, the proposed methodology integrates two complementary digital twin concepts: (i) detailed modeling of the physical behavior of optical hardware, including wave propagation, sampling, noise, and phase or tomographic reconstruction algorithms; and (ii) realistic modeling of biological specimens through digital microphantoms of cells, organoids, and tissues.

This combined approach enables end-to-end virtual experimentation under controlled and repeatable conditions. By integrating forward models, inverse reconstruction pipelines, and digital twins of measured objects, the digital twins of QPI systems facilitate systematic analysis of performance, sensitivity to experimental parameters, and trade-offs between spatial resolution, acquisition speed, and robustness. Biomedical use cases are demonstrated, including virtual imaging of cells and tissues, evaluation of refractive-index reconstruction accuracy, and optimization of illumination and acquisition strategies. The proposed framework supports instrument prototyping, algorithm development, and cross-modality comparison without reliance on extensive experimental trials, thereby accelerating the translation of advanced QPI technologies into biomedical applications such as cell biophysics, pathology, and label-free diagnostics.



Short Bio: Malgorzata Kujawska is a full Professor at the Institute of Micromechanics and Photonics, Faculty of Mechatronics, Warsaw University of Technology (WUT). She received her PhD degree in Photonics Engineering from WUT, Poland. She is an international expert in full-field optical measurement methods with applications in biomedical engineering, industry and cultural heritage. Recently she focus on metrology of 2D and 3D quantitative phase imaging systems and their application in biomedicine at cellular and tissue level. She is SPIE and OPTICA Fellow, past SPIE President, recipient of SPIE Chandra S. Vikram Award in Optical Metrology and SPIE Denis Gabor Award in Diffractive Optics.

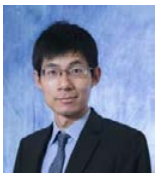
Coherence-gated optical diffraction tomography for label-free volumetric imaging of cells in thick tissues

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Optical diffraction tomography (ODT) has now become an important imaging modality for volumetric imaging of living cells and intracellular organelles by revealing their three-dimensional (3D) refractive-index distributions. However, resolving sub-cellular structures in thick tissues remains a significant challenge. We report a new coherence-gated ODT, termed speckle diffraction tomography (SDT), which uses dynamic speckle illumination to achieve imaging of thick biological specimens with around 0.5 μm transverse resolution and around 1 μm axial resolution. In SDT, multiple-scattering background is rejected through spatiotemporal gating provided by dynamic speckle-field interferometry using in a reflection-mode geometry, while depth-resolved refractive index maps are reconstructed by developing a comprehensive inverse-scattering model that also considers specimen-induced aberrations. Benefiting from the high-resolution and full-field quantitative imaging capabilities of SDT, we successfully imaged red blood cells and quantified their membrane fluctuations behind a turbid medium with a thickness of 2.8 scattering mean-free paths. Most importantly, we performed volumetric imaging of cornea inside an ex vivo rat eye and quantified its optical properties, including the mapping of nanoscale topographic features of Dua's and Descemet's membranes that had not been previously visualized without dissection. More recently, we extended the imaging depth of SDT to beyond 1 mm with NIR-II illumination and verified the sectioning capabilities using layered red blood cell samples and brain tissues in turbid medium.



Short Bio: Renjie Zhou received his PhD degree in Electrical and Computer Engineering from the University of Illinois at Urbana-Champaign in 2014, followed by postdoctoral training at the George R. Harrison Spectroscopy Lab at MIT before joining The Chinese University of Hong Kong (CUHK) in 2017. He is currently an Associate Professor at the Department of Biomedical Engineering and Electronic Engineering (by courtesy) at CUHK, where he directs the Laser Metrology and Biomedicine Lab. His research has been focused on advancing light microscopy technologies, specifically the field of quantitative phase imaging (QPI) and demonstrating the impact across fields. He has published ~ 70 journal papers in *Nature Photonics*, *Light: Science & Applications*, *Optics Letters*, etc., ~ 60 conference proceedings, and filed ~ 15 patents. He is a Fellow of SPIE and currently serves on the editorial boards of *Photonics Research* and *IEEE Photonics Technology Letters*. In recent years, he received the Croucher Innovation Awards from the Croucher Foundation (2019), the Young Scientist Award from the Electromagnetics Academy (2023), the Excellent Young Scientists Fund from the National Natural Science Foundation of China (2024), and the Hong Kong RGC Research Fellow Scheme (2025).

Quantitative Phase Microscopy and Phase Correlation Spectroscopy for Biology

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Label-free imaging of multiple intracellular organelles, as well as the transport or interaction of the organelles, is of great importance for biomedical study. In this talk, quantitative phase-contrast microscopy and tomography will first be presented, which features a high spatial resolution of 245 nm and strong immunity against external disturbance. With phase microscopy and tomography, we have captured several important dynamic processes of intracellular organelles, including chromosome duplication in mitosis, mitochondrial fusion and fission, filaments and vesicles' morphologies in apoptosis. Then, two-beam phase correlation spectroscopy (2B-PCS), which is based on the imaging platform of Qz-PCM, will be presented as a novel, label-free analysis approach to measure the dynamics of flowing particles. With 2B-PCS, the flow of (mainly) red blood cells in tail vessels of live zebrafish embryos was investigated. We believe that the investigated imaging platform can be extended to study many biological processes, promoting biomedical research and diagnosis.



Short Bio: Prof. Dr. Peng Gao, studied Physics and received his Ph.D. at the Xi'an Institute of Optics and Precision Mechanics (XIOPM), CAS, in 2011. He was a "Humboldt Fellow" in University Stuttgart (2012-2014) and Marie-Curie Fellow (IEF) in KIT (2014-2018). He is currently a PI at Xidian University. His group focuses on developing quantitative phase microscopy and super-resolution optical microscopy techniques for biology. So far, he has authored over 100 peer-reviewed papers published in journals, including Nat. Photonics, Adv. Opt. Photon. Some of

his publications were highlighted by tens of international media, such as Science Daily, Physics News, and so on. He is currently one of the associate editors of Optics and Laser Technology (OLT) and Frontiers in Physics.

Ultra-broadband spectroscopy from the UV to the THz using coherent and incoherent light sources

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Optical spectroscopy is an indispensable tool in non-invasive analysis of samples in all states of matter. Gas spectroscopy plays an essential role in environmental monitoring, while liquid and solid-state spectroscopy serve the pharmaceutical and semiconductor industries. Unfortunately, the common limitation of most optical spectrometers is their selective coverage. To tackle this challenge, we propose a Fourier spectrometer design that operates at light wavelengths from the ultraviolet (0.39 μm) to the THz range (90 μm). Using combined thermal sources, we cover the 1–50 μm range (300–6 THz) in the same experiment within seconds of acquisition. We also demonstrate the usefulness of our system in studies on new organic nonlinear crystals for ultra-broadband coherent THz generation. Such an instrument is expected to fuel the AI-driven spectroscopic revolution by including a wide range of absorption features.



Short Bio: Lukasz A. Sterczewski is an associate professor in the faculty of Electronics, Photonics, and Microsystems at Wroclaw University of Science and Technology in Poland. In 2023, he received the European Research Council (ERC) Starting grant for research on room temperature generation and detection of terahertz (THz) frequency radiation emitted by chip-scale semiconductor laser structures. Between 2015–2018 Dr. Sterczewski pioneered work on semiconductor laser frequency combs for broadband, high-resolution spectroscopy at Princeton University. From 2019 to 2021 he was a postdoctoral researcher at NASA Jet Propulsion Laboratory working on battery-operated mid-infrared frequency comb generators. In 2021 he returned to Wroclaw, Poland to explore the field of organic nonlinear optical crystals offering ease of fabrication and spectral coverage from the long-wave infrared to the THz. Now he continues his research journey as a group leader of the THz Optoelectronics Laboratory at Wroclaw University of Science and Technology.

All-optical microwave and THz sensors based on Rydberg atoms

Faculty of Physics & Centre for Quantum Optical Technologies, University of Warsaw, Poland

Michał Parniak

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Atomic systems have recently emerged as a disruptive alternative to classical microwave electronics, offering SI-traceable measurements and extreme sensitivity across a broad frequency spectrum. In this talk, we review the recent milestones in the development of Rydberg-atom-based sensors, focusing on the transition from fundamental proofs-of-concept to high-performance all-optical devices. A key breakthrough in this field is the recent demonstration of efficient microwave-to-optical conversion in room-temperature atomic vapors, which allows for the detection of microwave fields using low-noise optical methods.

We discuss the underlying physics of these transitions, drawing on our previous work in macroscopic spin-mechanical entanglement and high-capacity quantum memories to explain the limits of coherence and control in atomic ensembles. By integrating all-optical superheterodyne techniques with advanced quantum control, we show how our previous experimental successes in non-linear optics and photon counting provide a roadmap for surpassing the standard quantum limit in electromagnetic field sensing, with direct implications for future radiometry and THz technology.



Short Bio: Michał Parniak is an Associate Professor at the Faculty of Physics and Leader of the Quantum Optical Devices Group at the Centre for Quantum Optical Technologies, University of Warsaw. His research focuses on the intersection of quantum optics, atomic physics, and microwave engineering. He has made significant contributions to the fields of quantum memories, single-photon detection, and quantum optomechanics.

ObjSplat: Geometry-aware Gaussian surfels for active object reconstructions

Beijing Institute of Technology, China

Shaohui Zhang

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Autonomous high-fidelity object reconstruction is fundamental for creating digital assets and bridging the simulation-to-reality gap in robotics. We present ObjSplat, an active reconstruction framework that leverages Gaussian surfels as a unified representation to progressively reconstruct unknown objects with both photorealistic appearance and accurate geometry. Addressing the limitations of conventional opacity or depth-based cues, we introduce a geometry-aware viewpoint evaluation pipeline that explicitly models back-face visibility and occlusion-aware multi-view covisibility, reliably identifying under-reconstructed regions even on geometrically complex objects. Furthermore, to overcome the limitations of greedy planning strategies, ObjSplat employs a next-best-path (NBP) planner that performs multi-step lookahead on a dynamically constructed spatial graph. By jointly optimizing information gain and movement cost, this planner generates globally efficient trajectories.



Short Bio: Shaohui Zhang received his PhD degree in Optical Engineering from Tsinghua University. He is a Tenured associate professor of Beijing Institute of Technology, China.

Recent advances in single-shot computational ultrafast imaging

Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China

Jingdan Liu

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Observing transient phenomena in the durations of their occurrences (i.e., real-time) is significant to understanding many physical, chemical, and biological processes. Many transient phenomena have timespans from femtoseconds to picoseconds. Single-shot computational ultrafast imaging is a novel imaging modality that synergizes computational imaging with conventional ultrafast imaging methods (e.g. the streak camera) to record two-dimensional (2D) spatial information at hundreds of billions or trillions of frames per second of non-repetitive or difficult-to-reproduce transient events in real-time. Recently, we reported a new computational ultrafast imaging scheme — swept coded aperture realtime femtophotography (SCARF), which can capture non-repetitive 2D ultrafast events at up to 156.3 trillion frames per second in a single-shot measurement.



Short Bio: Jingdan Liu received her PhD degree in Optical Engineering from Beijing Institute of Technology. University. Currently, she is a professor of the Shanghai Institute of Optics and Fine Mechanics (SIOM), Chinese Academy of Sciences, where she leads the Laboratory of Computational Imaging Systems. Her research focuses on developing state-of-the-art computational imaging techniques and systems, particularly for diagnosing transient events in engineering, physics, and biomedicine. She has published >20 papers, including Nature Communications and Optica, and has applied for 2 U.S. patents. She is a Member of Optica and SPIE and holds several prestigious roles, including serving on the Committee of High-Speed Imaging and Photonics, Chinese Optical Society (COS) as a - 2 - member and as a Young Editorial Board member of Ultrafast Science since 2025. Her contributions have been widely recognized through numerous accolades. In 2024, she was awarded the Overseas Excellent Youth Science Foundation by the National Natural Science Foundation of China (NSFC). She also received the 2021 Relève Étoile Louis-Berlinguet award from the Fonds de recherche du Québec – Nature et technologies (FRQNT) in Canada. Notably, her research was featured in Optica’s Year in Optics in both 2021 and 2024

Spatiotemporal super-resolution of structured-light 3D imaging driven by physical priors and artificial intelligence

Nanjing University of Science and Technology, China

Shijie Feng

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While structured light 3D imaging is widely applied, its performance remains limited by hardware bandwidth, low signal-to-noise ratio, and traditional frame-by-frame analysis. This presentation introduces our progress in spatiotemporal super-resolution achieved by fusing physical priors with artificial intelligence. First, we utilize multi-dimensional multiplexing (color, frequency, and direction) for single-frame high-density temporal coding, boosting the equivalent imaging rate to 16 and 24 times the camera's frame rate. Second, we propose a depth-aware temporal inference method that enables kilohertz-level 3D imaging using hundred-hertz-level sensors, improving temporal resolution by up to 45 times. Finally, we construct a physics-guided framework for spatiotemporal fringe analysis and spatial super-resolution, significantly enhancing reconstruction precision, robustness, and spatiotemporal consistency. This work provides new insights for developing next-generation ultra-high-speed intelligent optical measurement systems.



Short Bio: Shijie Feng is a Zijin Distinguished Professor and doctoral supervisor at Nanjing University of Science and Technology, selected for a national high-level young talents program. His research focuses on high-speed 3D measurement based on structured-light illumination. He has published more than 70 SCI-indexed papers with over 9,000 Google Scholar citations. He has been selected as a Clarivate "Highly Cited Researcher" and listed in Stanford University's "World's Top 2% Scientists" (Career-long impact). As a key contributor, he received one First Prize of the Jiangsu Science and Technology Award and two First Prizes of the CSOE Technological Invention Award.

From chemical contrast to scattering-robust tomography: broadband lensless computational microscopy for label-free high-content bioimaging

Warsaw University of Technology, Poland

Maciej Trusiak

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Lensless holographic microscopy offers a powerful route to high-content two- and three-dimensional imaging over large fields of view, but its broader use is often constrained by limited chemical specificity and by multiple scattering in optically dense samples. In this lecture, I will present a unified lensless imaging framework implemented on a standard CMOS camera and operating across an exceptionally wide spectral range, from deep ultraviolet (~240 nm) to the silicon cut-off near 1100 nm. This platform enables UV absorption imaging of cells and tissue slices with intrinsic chemical contrast, near-infrared complex-field imaging with reduced scattering in turbid specimens, and multiple-scattering-aware phase tomography at gigavoxel scale. Together, these advances show how a simple on-chip detector platform can support computational microscopy and tomography across complementary spectral regimes, opening new possibilities for mesoscale information-rich imaging of highly heterogeneous biomedical samples.



Short Bio: Maciej Trusiak is an Associate Professor at the Institute of Micromechanics and Photonics, Faculty of Mechatronics, Warsaw University of Technology (WUT). He earned his B.Sc., M.Sc., and Ph.D. degrees in Photonics Engineering from WUT in 2011, 2012, and 2017, respectively. Following his doctoral studies, he completed a one-year postdoctoral fellowship in the Optoelectronic Image Processing Group led by Prof. Javier

García and Prof. Vicente Micó at the University of Valencia, Spain. In 2022, he obtained his habilitation degree and launched the Quantitative Computational Imaging Lab (qcilab.mchtr.pw.edu.pl), focusing on computational imaging, lensless microscopy, optical metrology, interferometry, holography, quantitative phase imaging, and biophotonics. In 2023, he was awarded the ERC Starting Grant for research on lensless, label-free holotomography and nanoscopy. Prof. Trusiak is an active member of the optical science community; he is a Senior Member of SPIE and Optica. He has held various organizational roles, including Program Chair of Optica Computational Optical Sensing and Imaging (COSI) conference. He currently serves as Executive Editorial Board Member of Journal of Physics: Photonics (IOP), Editor of Optics and Lasers in Engineering (Elsevier), Associate Editor of Applied Optics (Optica Publishing Group), and Editorial Board Member of Advanced Devices & Instrumentation (AAAS Science Partner Journal).

Computational phase imaging for label-free 3D microscopy: noninterferometric phase retrieval and intensity diffraction

Nanjing University of Science and Technology, China

Chao Zuo

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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.



Short 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.

Common-Path Diffraction Tomography: Overcoming the Conjugate Image Problem in Dense Samples

Warsaw University of Technology

Piotr Zdańkowski

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Quantitative phase imaging (QPI) and optical diffraction tomography (ODT) are powerful label-free tools, yet their translation to high-throughput settings is limited by laser speckle, the mechanical instability of angular scanning, and the conjugate image problem in shearing interferometry, where overlapping replicas corrupt reconstructions of dense samples.

To overcome these limitations, we present a compact, common-path grating system based on liquid-crystal polarization gratings. This architecture is inherently vibration-robust and uniquely tailored to operate with low-coherence LED illumination. By utilizing programmable LED addressing, we achieve high-speed, speckle-free tomographic cone illumination entirely without moving parts.

To resolve highly confluent biological samples in a single shot, a polarization-resolved sensor captures orthogonal phase shifts simultaneously. We implement an optimization-based conjugate replica removal framework that suppresses overlapping beam artifacts. This enables high-fidelity gradient visualization (qDIC) and accurate phase recovery. For volumetric reconstruction, Gradient Optical Diffraction Tomography (GODT) directly maps these recovered phase gradients into 3D refractive index distributions via the Rytov approximation. Validated on 3D cell phantoms and highly confluent neural cells, our platform delivers mechanically stable, high-throughput, label-free 3D microscopy.



Short Bio: Piotr Zdańkowski is an assistant professor at the Institute of Micromechanics and Photonics, Faculty of Mechatronics, Warsaw University of Technology. He specializes in advanced optical imaging techniques, with a primary focus on super-resolution microscopy, adaptive optics, quantitative phase imaging (QPI), and optical diffraction tomography (ODT). Piotr earned his PhD from the University of Dundee in 2018, where he was developing a system integrating adaptive optics into stimulated emission depletion (STED) microscopy, for 3D imaging of biological samples.

Currently, Piotr co-leads the Quantitative Computational Imaging Lab (QCI Lab), developing cutting-edge imaging methodologies including common-path QPI and ODT, Fourier Ptychographic Microscopy (FPM), lensless microscopy and super-resolution fluorescence microscopy.

Phase Manipulating Fresnel Lenses for Differential Interference Quantitative Phase Microscopy

Harbin Engineering University, China

Shengjia Wang

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Quantitative phase imaging (QPI) is said to be a key technology for the next generation of label free imaging. In this talk, I will present a differential interference approach based on phase manipulating Fresnel lenses (PMFL), which aims to address the challenges of integrated QPI and, more specifically, wavefront sensing. This approach breaks through the conventional design routine of differential interferometer by converting it from the combination of individual optical elements to the direct spatial manipulation of phase. The essential functionalities for differential interference in QPI, namely sample imaging, differential operation, and phase shifting, are integrated into a single dynamic phase manipulation mask. the differential interference microscope is miniaturized using an off-the-shelf SLM. Moreover, to tackle the space-bandwidth product (SBP) mismatch between conventional microscope objectives and digital cameras, the PMFL provides a back-end field-of-view (FOV) scanning function that scans the FOV across the camera sensor. We have developed the PMFL module to achieve high-SBP phase imaging of transparent samples with an extended camera FOV, effectively bridging the SBP gap between objective lenses and digital cameras. The PMFL serves as an add-on module to a bright-field microscope, upgrading it from a bright-field imaging modality to a wide-field QPI system. We will demonstrate its applications in wavefront sensing, including QPI of artificial/biological specimens and its potential for measuring geometric quantities.



Short Bio: Shengjia Wang received his bachelor's and master's degrees from Beijing Jiaotong University (BJTU) in 2012 and 2015, respectively. He received his doctoral degree from the Technical University of Munich (TUM), Germany, in 2020. During 2018, he had an academic stay at the Technical University of Denmark (DTU), Denmark. Since 2020, Dr. Wang has worked as an associate professor at Harbin Engineering University (HEU), is the head of the Laboratory of Optics in Free Space (LOFS), and vice director of the Photonics Center. He is now the Deputy Secretary-General of the Heilongjiang Optical Society. At present, he is mainly engaged in research on differential/shearing interferometric techniques and their applications, including quantitative phase imaging and optical shop testing. In recent years, he has authored and co-authored more than 60 SCI academic papers in ACS Photonics, Optics Letters, Optics Express, IEEE Transactions on Instrumentation and Measurement and other journals. Dr. Wang is responsible for multiple national scientific research projects, including NSFC, and was granted with the Excellent Young Scientists Fund of Heilongjiang province in 2021. In the same year, he was selected as high-level talents in Heilongjiang Province.

Learning to self-interfere: zero-shot deconvolution enables replica-free, low-coherence common-path quantitative phase microscopy

Nanjing University of Science and Technology, China

Zhuoshi Li

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Digital holographic microscopy enables full-field, label-free, and high-precision quantitative phase imaging (QPI), yet its performance is often limited by speckle noise, parasitic artifacts, and vibration sensitivity resulting from the use of highly coherent illumination and a separate reference beam path. While reducing illumination coherence facilitates suppressing speckle and parasitic fringes, it typically requires a common-path self-interference configuration, leading to replica images that hinder quantitative analysis of dense biological specimens. In this talk, I will introduce replica-free total-shear three-beam common-path digital holographic microscopy (RF-CPDHM), which resolves this long-standing dilemma by coupling physical modeling with a deconvolution-prior zero-shot learning strategy. By formulating replica removal as an ill-posed inverse problem and solving it in an unsupervised manner, RF-CPDHM achieves high resolution, high SNR, and full-field QPI without any ground truth or training data. RF-CPDHM enables quantitative visualization of organelle dynamics, including lipid droplets and vesicles, in PLC cells under oleic acid treatment, revealing lipid-homeostasis regulation and demonstrating its broad potential for label-free quantitative studies in cell biology, pathology, and pharmacology.



Short Bio: Zhuoshi Li is a Ph.D. candidate at Nanjing University of Science and Technology. His research focuses on quantitative phase microscopy, including digital holographic microscopy and Fourier ptychographic microscopy. He has published 11 SCI-indexed papers (including *Opto-Electronic Science* and *ACS Photonics*) and 6 international conference papers, with over 250 Google Scholar citations. As a rising researcher, he was recognized as one of the National Top 100 in the Light Conference

Academic League.

2026 年全国光学与光学工程博士生学术联赛全国总决赛

时间	内容
6 月 13 日，星期六（东北亚国际会议中心，1F 106 华山厅）	
09:00-09:30	总决赛开幕式
09:30-09:45	1 号选手 - 东北赛区 报告题目：基于 OPGW 光缆通感融合的特高压输电线路防冰抗冰技术研究
09:45-10:00	2 号选手 - 华南赛区 报告题目：基于氮化硅光栅微环的集成非线性光子器件研究
10:00-10:15	3 号选手 - 上海赛区 报告题目：基于几何相位的硅基集成光子器件
10:15-10:30	4 号选手 - 华北赛区 报告题目：非接触光声显微 -- 高分辨成像与跨场景应用探索
10:30-10:50	茶歇
10:50-11:05	5 号选手 - 北京赛区 报告题目：光学 - 系统协同的视网膜级分辨率 3D 光场显示技术
11:05-11:20	6 号选手 - 西北赛区 报告题目：单壁碳纳米管太赫兹超表面共振机理及应用研究
11:20-11:35	7 号选手 - 海峡赛区 报告题目：大视场高速光学相控阵芯片研究
11:35-11:50	8 号选手 - 华中赛区 报告题目：可控超快激光及精密测量应用
11:50-12:05	9 号选手 - 北京赛区 报告题目：基于多焦点调制照明的深层超分辨显微成像系统
12:05-13:45	午休
13:45-14:00	10 号选手 - 西北赛区 报告题目：集成化偏振复用正交剪切干涉定量相位成像技术
14:00-14:15	11 号选手 - 华中赛区 报告题目：智控驭光：大规模光纤激光阵列智能锁相
14:15-14:30	12 号选手 - 东北赛区 报告题目：高光谱分辨率沙氏激光雷达技术研究
14:30-14:45	13 号选手 - 上海赛区 报告题目：高分辨率 X 射线波带片制作技术研究
14:45-15:00	14 号选手 - 华北赛区 报告题目：多参数量子干涉仪
15:00-15:15	15 号选手 - 华北赛区 报告题目：面向海洋参数监测的微结构光纤混合干涉传感技术研究
15:15-15:40	茶歇

15:40-15:55	16号选手 - 鲁苏皖赛区 报告题目: 液晶平面光子元件赋能的双面环绕式增强现实三维显示
15:55-16:10	17号选手 - 华南赛区 报告题目: 激光高相干暂稳态的可控复现
16:10-16:25	18号选手 - 西南赛区 报告题目: 基于超薄硅基超透镜的智能成像研究
16:25-16:40	19号选手 - 华南赛区 报告题目: 基于光场调控的各向同性三维超分辨成像技术
18:00-20:00	晚餐
6月14日, 星期日 (东北亚国际会议中心, 1F 106 华山厅)	
09:00-09:15	20号选手 - 北京赛区 报告题目: 深度学习驱动的单端多模光纤柔性机器人通用形态感知
09:15-09:30	21号选手 - 海峡赛区 报告题目: 基于辐射调Q复变传感的晶圆级非局域超表面及其临床应用
09:30-09:45	22号选手 - 海峡赛区 报告题目: 仿生微光学触角: 微纳尺度下的超灵敏多模态智能感知
09:45-10:00	23号选手 - 西北赛区 报告题目: 基于完全频谱解耦超表面的多维伪装集成技术
10:00-10:15	24号选手 - 上海赛区 报告题目: 基于选择性光谱盲响应的高对比度红外光谱探测
10:15-10:35	茶歇
10:35-10:50	25号选手 - 北京赛区 报告题目: 电光梳赋能的调频连续波激光雷达
10:50-11:05	26号选手 - 海峡赛区 报告题目: 超快激光诱导热塑性介质色散微涡旋及其光谱学应用
11:05-11:20	27号选手 - 华北赛区 报告题目: 高维光场赋能涡旋光干涉仪
11:20-11:35	28号选手 - 北京赛区 报告题目: 基于符合计数的量子伽柏全息成像
11:35-11:50	29号选手 - 鲁苏皖赛区 报告题目: 基于傅里叶叠层的高深宽比微结构三维形貌干涉测量
11:50-13:30	午休
13:30-15:00	学术联赛闭幕式和颁奖典礼

Poster List

Number	Content
1	Interactively addressable organic metadevices Xiangyu Huang ^{1,2} , Laura Na Liu ^{1,2*} 1. Max Planck Institute for Solid State Research; 2. University of Stuttgart
2	Data-driven precise extraction and division of spatial frequency band errors Yuan Liu, Xiaokun Wang*, Yukun Wang, Donglin Xue, Xuejun Zhang Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences
3	Development of Heterodyne Brillouin Microscopy Noemi D'Abbondanza Sapienza University of Rome
4	Application of Diffractive Optical Element-Based Optical Coherence Tomography in Complex Component Inspection Chengchen Zhou, Yukun Wang*, Dacheng Wang, Xiaokun Wang Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences
5	A new potential choice of high performance laser glass fiber Jianwei Li, Tao Zheng*, Yanyan Guo, Jingwen Lv, Kaifeng Sun, Baikang Wang, Qibo Zhang Changchun University of Science and Technology
6	Rapid Preparation of Eu ₂ Ti ₂ O ₇ and Its Lithium Storage Performance Yan Wang, Jieming Qin* Changchun University of Science and Technology
7	Nanoparticulate selective thermal emitter for mitigating urban heat islands Jiayu Song, Ioannis Papakonstantinou* University College London
8	Training of Free-space Optical Networks for Visual Information Processing Jingtian Hu Harbin Institute of Technology
9	Metasurface-enabled polarization-selective vortex beams through Bloch Surface Waves diffraction Zongyuan Tang ^{1,2} , Niccolò Marcucci ³ , Yanjun Liu ² , Matthieu Roussey ⁴ , Tianlong Guo ⁴ , Emiliano Descrovi ^{1*} 1. Politecnico di Torino; 2. Southern University of Science and Technology; 3. Institute of Applied Physics IFAC-CNR; 4. University of Eastern Finland
10	A Unified Abbe-Hopkins Framework for Source-Mask Optimization in Advanced Lithography Ying Wang, Shuting Cai*, David H. Wei* Guangdong University of Technology
11	How to calculate the skyrmion number from a topologically protected field Liangyu Deng, Chao He* University of Oxford
12	Unveiling Electronic Regulation Mechanism in Amorphous FeSe _x /Crystalline NiSe ₂ Heterointerface for Alkaline Overall Water Splitting Shuang Zhao Changchun University of Science and Technology
13	Microcavities for Dual- and Multi-Wavelength Semiconductor Lasers Using a Central Fabry-Pérot Cavity and End Continuous Phase-Shift Gratings Zhefan Wang*, Mohanad Rubaiee, Ahmet Hezarfen, Lianping Hou University of Glasgow
14	Ultra-long Single-ended ϕ -OTDR Enabled by Integrated Coherent Pulse and Link Optimization Jiale Duan ¹ , Yanyang Lei ¹ , Zeying Lin ² , Zhijie Zhou ^{2*} , Tianfu Li ^{1*} , Yongkang Dong ^{1*} 1. Harbin Institute of Technology; 2. Harbin Normal University

15	Free-space Optical Visual Processors Jingtian Hu* Harbin Institute of Technology
16	Microlaser with Topological Emissions Zhifeng Zhang* Nanjing University
17	Parametric Curvilinear Mask Optimization with Analytically Model and Gradient-based Algorithm Chenle Cao, Mu Lin, Xu Ma* Beijing Institute of Technology
18	Intelligent High-content Super-resolution Microscopy Hao Zhang* Eastern Institute of Technology
19	Research on the Influence of Barrier-Dispersed EBL Structure on Non-polar a-plane Deep Ultraviolet LEDs Jiawei Yang, Hongchang Tao* Xidian University
20	Broadband Unpolarized Directional Thermal Emission Laraib Zafar, Kossi Aniya Amedome Min-Dianey, Tianji Liu*, Wei Li* Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences
21	Longwave-transparent low-emissivity material Yue Zhang, Xiaowen Zhang, Longnan Li, Wei Li* Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences
22	Möbius-like Real-Space Topology Reshapes Spectral Winding Topology in Hatano–Nelson Rings Yekai Shen, Shuhang Chen, Zishun Liao, Zhipeng Li* University of Science and Technology of China
23	Nano-atto Imaging of Spatiotemporal Plasmonic Vortices on Chip Qian Chen ¹ , Shuoshuo Zhang ² , Guoyu Xian ³ , Haoqiang Hu ¹ , Xiaohua Wu ¹ , Xiaofei Wu ⁴ , Jer-Shing Huang ⁴ , Chen-Bin Huang, Jinhui Zhong ¹ , Yunquan Zhang ² , Xiaocong Yuan ² , Changjun Min ² , Yanan Dai ¹ 1. Southern University of Science and Technology; 2. Shenzhen University; 3. Institute of Physics, Chinese Academy of Sciences; 4. Leibniz Institute of Photonic Technology
24	Evolution and Combination of Light Line Singularities Jiawei Wang ¹ , Mengqi Liu ² , Tianji Liu ¹ , Weijin Chen ³ , Yue Ma ¹ , Qiuyu Wang ¹ , Wei Li ^{1*} 1.Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences; 2.Shanghai Jiao Tong University; 3.National University of Singapore;
25	Quantum Hall coherent perfect absorption in graphene Dariush Jahani Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences
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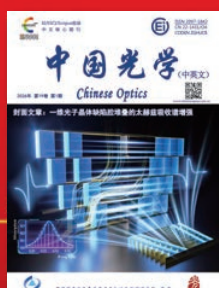
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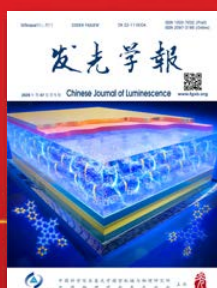
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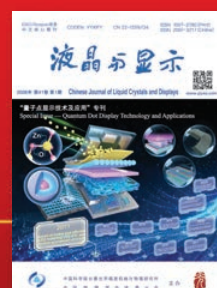
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