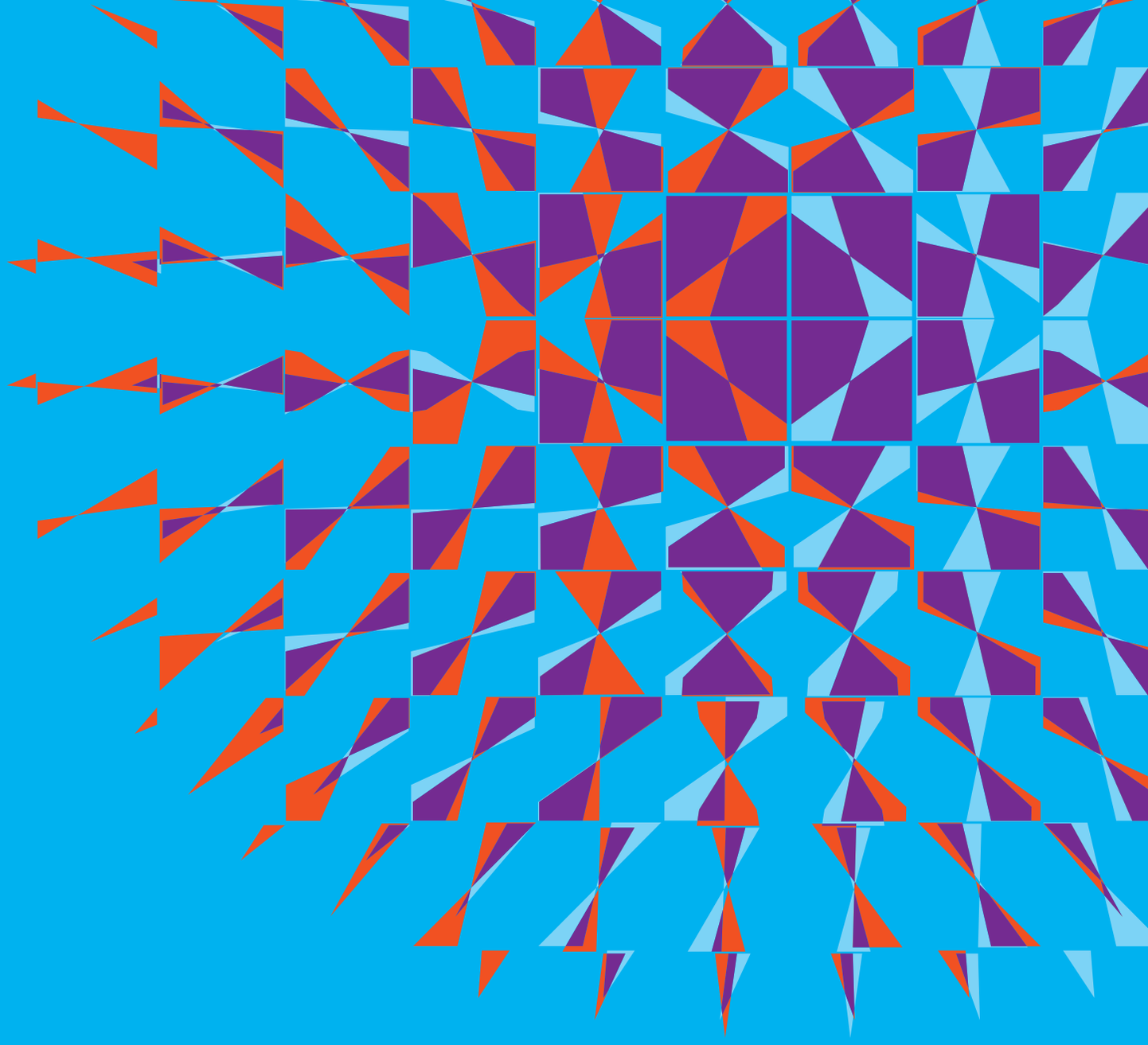
2026世界青年科学家峰会摘要集
WORLD YOUNG SCIENTIST SUMMIT 2026 ABSTRACT COMPILATION



2026 世界青年 科学家峰会 摘要集

WORLD YOUNG SCIENTIST SUMMIT 2026 Abstract Compilation

中国 温州

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WYSS 2026

WORLD YOUNG SCIENTIST SUMMIT
世界青年科学家峰会

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01 未来制造前沿论坛
Frontier Forum on the Future of Manufacturing

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罗少卿

Manufacturing Intelligent Wearables

汇报人：Seeram Ramakrishna
单位：清华大学

This report takes the manufacturing of wearables as its main thread and emphasizes that future manufacturing is the core engine driving intelligent wearables from the laboratory to industrialization, scale-up, and sustainable development. Electrospinning-based nanofiber manufacturing serves as the key technological foundation, spanning the full chain from material preparation, fiber/yarn formation, and fabrication of flexible electrodes and sensors to the manufacture of energy-supply and actuation units, device packaging, and conformal integration with textiles. This builds a scalable, customizable, green, and low-carbon advanced manufacturing system. Future manufacturing translates the advantages of nanofibers-high specific surface area, flexibility, breathability, and skin conformity—into real functions of wearable devices: fibrous multimodal sensors enable continuous monitoring of ECG, EMG, and sweat; self-powered fibrous devices support passive tactile sensing and motion recognition; adaptive fibrous actuators respond to stimuli such as temperature, humidity, and electric fields; integrated fiber-based storage–communication–computing advances edge intelligence; and bio-interactive manufacturing enables closed-loop health intervention from the molecular to organ level. Addressing bottlenecks such as battery life, comfort, data accuracy, and privacy security, the report points out that future manufacturing will deeply integrate materials, mechanical engineering, energy, information, and biomedicine. Supported by digital, intelligent, robotic, and AI-driven processes, it will achieve low-cost, high-reliability, personalized, and large-scale production. Future manufacturing not only determines the performance boundaries of wearable devices but also shapes their industrial ecosystem and global competitiveness, driving wearables from passive monitoring toward active intervention, self-powered operation, and edge intelligence, and providing a manufacturable roadmap for next-generation smart textiles and health management.

One-Dimensional van der Waals Heterostructures Based on Single-Walled Carbon Nanotubes

汇报人：Shigeo Maruyama

单位：School of Mechanical Engineering, Zhejiang University; Department of Mechanical Engineering, The University of Tokyo; Institute of Materials Innovation, Nagoya University

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The properties of single-walled carbon nanotubes (SWCNTs) can be tailored by modifying either their interior or exterior. Confined carbyne exemplifies interior modification. We recently synthesized weakly confined carbyne at low temperature, approaching the free-standing limit. I will discuss strategies to scale up its synthesis and extend it to chirality-sorted SWCNTs. For exterior modification, we have demonstrated atomically precise one-dimensional van der Waals (1D vdW) heterostructures by sequentially coating SWCNTs with boron nitride nanotubes (BNNTs) and molybdenum disulfide (MoS_2) nanotubes. We have investigated the growth mechanism of SWCNT–BNNT heterostructures and characterized their optical and field-effect transistor properties. We have also optimized chemical vapor deposition conditions for several transition-metal dichalcogenides (TMDs), including tungsten disulfide (WS_2), molybdenum diselenide ($MoSe_2$), and niobium disulfide (NbS_2). A remote-salt technique enabled control over the growth of WS_2 and NbS_2 nanotubes. Plasma-assisted selenization of MoS_2 nanotubes produced Janus MoSSe nanotubes, preferentially yielding single-walled structures with diameters of approximately 8–10 nm. BNNT interior cavities also serve as nanoscale templates: MoS_2, WS_2, and SnS_2 nanotubes grown inside BNNTs show a strong preference for armchair configurations, suggesting that they form from zigzag nanoribbons .

高性能半导体器件用衬底的高效精密磨粒加工

High-efficiency precision abrasive machining of substrates for high-performance semiconductor devices

汇报人：徐西鹏

单位：华侨大学

高性能半导体器件的发展对衬底材料性能和加工质量的要求不断提高。相对于传统衬底材料，以碳化硅、金刚石等为代表的新型半导体材料因其优异的电学性能，在高性能半导体器件制造领域受到广泛关注。但是这类材料的加工也因其性能极端而遇到很大挑战。报告围绕该类衬底的磨粒加工，从加工界面作用机制、材料去除机理、工具制备与改性、工艺优化等方面进行介绍。

难切削材料快速放电铣削加工技术进展

Advances in fast electrical discharge milling of difficult-to-cut materials

汇报人：赵万生

单位：上海交通大学 机械与动力工程学院

快速放电铣削技术利用管电极高速内冲液，可以将放电所产生的加工产物快速排出放电间隙，可实现难切削材料的高效快速去除加工。结合多轴联动数控轨迹控制，可以实现复杂型面的快速放电铣削工艺。在铝基碳化硅复合材料、镍基高温合金、陶瓷基复合材料的加工方面具有较好的工业应用前景。本报告将具体介绍该技术的最新研究成果。

高端装备复杂曲面金属件原子级制造基础研究

Fundamental research on atomic-level manufacturing of complex curved-surface metal parts for high-end equipment

汇报人：钱林茂

单位：西南交通大学

制造先后经历了宏观制造、微米制造和纳米制造等多个发展阶段，制造精度不断提升，带来了装备性能的飞跃，也推动了人类文明的进步。原子级制造是指将能量作用于原子，通过原子尺度的大规模增材、减材或复合制造过程，实现产品性能与功能跃迁的前沿制造技术。原子级制造是制造科学和技术发展的必然趋势，既是解决我国高精尖装备“卡脖子”问题的关键利器；也是引领未来制造科学发展以至产业技术变革必须抢占的战略“制高点”。高性能滚动轴承等是决定轨道交通等领域的高端装备能否安全可靠服役的关键部件。它们的核心工作面为多元多相金属材料复杂曲面，其精度和表面完整性直接决定了产品的性能和可靠性。纳米摩擦学是纳米精度抛光的基础。为了提升高端装备使役性能，亟需开展面向复杂曲面金属件超精密低损伤制造的摩擦学基础研究，实现原子级精度材料可控去除，获得高性能机械表面/界面。为此，本报告研究提出多场辅助原子级抛光原理与方法，解决多元多相金属材料差异性同步去除难题。研究成果有望突破高铁轴承等核心元件超精密、低损伤加工瓶颈，为新一代超高速列车、低噪声航天器的研发提供关键技术支撑，推动我国高端装备自主创新能力与核心竞争力的全面提升。

纳米缺陷检测方法及应用

Inspection methods for defects at nano scale and applications

汇报人：杨树明

单位：西安交通大学

纳米测量技术已经在航空航天、集成电路、生物医学等领域得到了广泛应用，但是对于缺陷尤其是纳米缺陷检测却并不能完全胜任，而在实际应用中表面和亚表面缺陷对于元器件的性能具有重要影响，亟需发展纳米缺陷检测方法和技术。该报告将介绍目前纳米缺陷检测方法存在的问题以及可能的解决途径。

超精密光栅位移测量技术

Ultra-precision grating displacement measurement technology

汇报人：李文昊

单位：中国科学院长春光学精密机械与物理研究所

面向高端制造领域对高精度、大量程位移测量的迫切需求，开展了大尺寸光栅制造及位移测量技术研究。在光栅制造方面，突破了米级尺寸、原子精度测量光栅制造难题，研究了复杂物理场耦合下极限精度反馈机制、控制机理与检测策略，研制出面积 1500mm×420mm、衍射波前 0.327λ@632.8nm 的全息光栅。在位移测量方面，提出了锥面衍射偏振调制方法，建立了双向多普勒单点衍射多倍细分构型，攻克了双光栅共模误差抑制技术，研制了亚米级和米级光栅位移传感器。相关成果为国产高端制造设备提供了高精度、大量程位移测量。

面向超精密光学系统的原子级制造技术

Atomic-level manufacturing technology for ultra-precision optical systems

汇报人：张鑫泉

单位：霖鼎光学有限公司/上海交通大学

超精密光学系统在半导体装备等高端制造系统中承担精度传递与功能实现的重要作用，其全频段制造精度要求已达纳米乃至亚纳米级，超精密制造技术是保障光学系统性能的核心关键。本报告聚焦超精密光学系统的制造需求，结合超精密制造技术数字化和智能化的发展趋势，汇报团队近几年在超精密光学元件制造方面的创新工艺和装备等代表性突破和进展，包括超精密加工和检测的新理论和新方法，以及承载新技术的专业机床和仪器，为超精密光学系统的精度提升和创新发展提供技术支撑。

服务于半导体装备超精密制造与检测的微环境控制技术

Micro-environment control technology for ultra-precision manufacturing and inspection of semiconductor equipment

汇报人：薛飞

单位：浙江启尔机电技术有限公司

半导体装备是集成电路制造的基石，其超精密制造与超精密检测能力直接决定工艺节点的演进水平。当精度进入纳米乃至亚纳米量级，温度、洁净度、湿度、压力与气流等多物理场的微小波动已成为制约装备性能极限的关键因素。

本报告面向半导体制程核心装备的实际工况，将温度、气流、压力、洁净度等多场耦合的环境变量统一设计，形成可装机、可裁剪、可复制的分级模块化产品族。直面量产约束——厂务水温、水压、水质存在波动，机台内部热源分布不均，装机空间受限——保证在上述条件下持续输出 mk 级温度稳定性与 Class 1 级洁净环境，帮助装备端把精度、良率与在线运行时间稳定在可承诺水平。

关键技术包括高精度水冷温控（±0.002 ℃）、两级气浴温控、纯化气体保护、热抽排隔离与多参数在线监测，并依托结构设计与温度/压降仿真—实验闭环完成换热器与流道优化。成果可形成面向各类半导体装备的微环境控制通用解决方案，为提升装备精度、工艺良率与运行可靠性提供技术支撑。

“电子风力”原子级缺陷调控与单晶金属纳米线固相生长

Atomic-Scale Defect Control based on Electron Wind Force and Solid-State Growth of Single-Crystal Metal Nanowires

汇报人：巨阳

单位：浙江大学

利用高密度脉冲电流所激发的电子对原子的冲击力（电子风力，Electron Wind Force），可以实现金属材料内原子排列的高秩序化，以及位错的移动及湮灭。电子风力可以导致新晶界，孪晶界面及共格相界的产生，并引起晶体结构、晶体方位以及相组织的改变。因此，原子有序化重排和晶体组织的优化，可以提高材料的电学及力学性能，从而可用于改善加工硬化，消除残余应力，增加强度、延性及韧性，以及用于材料的损伤与裂纹的修复。本报告将通过具体的研究案例展示“电子风力”对原子尺度缺陷的修复与调控能力。另一方面，纯铝纳米线是高性能光电器件的理想材料，但受限于铝的蒸汽压与化学还原难题，传统方法生长的纳米线密度与覆盖率极低，大规模、高密度、有序化纳米线生长一直难以实现。本研究原创性地提出了 “应力梯度驱动固相原子迁移与组装” 的新原理。通过聚焦离子束在铝薄膜中诱导局部晶粒粗化，形成晶粒梯度，从而在固体内部构建起可控的应力场，驱动铝原子在固态下的有序迁移与组装，实现了单晶铝纳米线森林的生长，解决了高密度纯金属纳米线无法大规模可控生长的难题。

一种面向光学表面中频误差的自适应稀疏建模及特征提取方法

An Adaptive Sparse Profiling and Extraction of Composite Texture Method for the Mid-Spatial Frequency Characterization of Optical Surfaces

汇报人：张志辉

单位：香港理工大学

中频（MSF）误差会损害光学表面的性能，但常规表面计量技术难以将其有效提取。本报告提出了一种基于形态成分分析的自适应稀疏轮廓分析与复合纹理提取（ASPECT）方法，该方法能从表面测量数据中准确提取包含制造特征的 MSF 信息，并将其与面形误差及随机噪声区分开来。针对抛光熔融石英基底的实验评估表明，ASPECT 方法实现了空间一致性；这不仅验证了 MSF 误差提取的鲁棒性，也凸显了采用边界缓解策略以实现均匀全场表征的必要性。

金刚石表面石墨烯改性新方法，新结构与应用基础

A novel method for graphene modification of diamond surfaces: new structures and its application foundation

汇报人：何宁

单位：南京航空航天大学

介绍一种激光诱导结合机械解理新方法，在大气环境下，使金刚石表面瞬时形成共价键结合的金刚石-纳米石墨-石墨烯（CDGG）新表层结构；分析金刚石向高取向石墨、石墨向石墨烯转化的能量传递、晶格重构与层间解理机制，建立金刚石涂层石墨化阈值功率、临界崩落功率调控模型；CDGG 新表层结构协同出金刚石-纳米石墨和石墨烯的综合性能，减低摩擦系数，抗机械化学磨损，电磁学方面也表现出良好的性能；介绍 CDGG 在航空航天、机械、电子等领域的应用基础研究，表面其广阔的潜在应用前景。

保形光学窗口元件的超精密加工技术

Ultra-Precision Machining of Conformal Optical Windows

汇报人：赵清亮

单位：哈尔滨工业大学机电工程学院

保形光学窗口元件可支撑未来先进飞行器在空气动力学、隐身等性能方面的提升。然而，窗口材料的难以去除、高陡度、加工轨迹复杂、加工过程闭环刚度变化、凹凸面光轴精度不易保障、在位及离线检测难度高等特性，导致其超精密加工精度难以获取、效率低、成本高等难题。在本讲座中，围绕蓝宝石、镁铝尖晶石、氮氧化铝等轴回转对称保形头罩，蓝宝石保形侧窗，多晶金刚石球罩等光窗元件，针对其超精密加工过程中的材料去除机理、工具轨迹规划、工具磨损及精密修整、在位检测、工装难题进行阐述，沥青其确定性及非确定性因素，为保形光窗的超精密加工技术发展提供新思路。另外，作者也将对未来保形窗口元件的超精密加工所要解决的装备及工艺问题，分享见解。

飞秒激光-电化学复合微增材制造技术研究

Research on Femtosecond Laser-Electrochemical Hybrid Micro-Additive Manufacturing Technology

汇报人：许金凯

单位：长春理工大学

随着航空航天、电子电路等领域对微米级金属微结构的需求激增，其高性能制造面临严峻技术挑战。本研究创新性提出飞秒激光诱导电化学沉积技术，阐明了激光增强电极反应动力学、液相传质及电结晶过程的作用机制；揭示了点-面-体跨尺度结构的成形演化规律，明确了激光对三维微结构成形过程的调控机理。未来研究中，将构建智能协同调控体系，融合多物理场模拟方法，进一步揭示光-电耦合作用机制；拓展镍、锌等多材料体系，实现梯度功能结构的可控制造，为高性能微结构制造开辟新路径。

五轴振镜激光加工技术与装备研发进展

R&D Progress in Five-Axis Galvanometer-Based Laser Processing Technology and Equipment

汇报人：周伟

单位：厦门大学

高深径比微孔及负锥度微结构在航空航天、智能传感等领域应用广泛。然而，传统激光加工技术受限于激光入射角度固定、光束空间调控自由度不足等问题，难以兼顾复杂微孔结构的成形精度、加工质量与制造效率。本报告围绕五轴振镜激光加工技术与装备研发，重点介绍五轴振镜激光系统光路设计、多轴协同运动控制及精密加工工艺等方面的研究进展。通过自主研制五轴振镜激光加工模块与装备，实现激光焦点位置与入射方向的灵活控制，突破了传统三维振镜激光在高深宽比和负锥度微结构加工中的技术局限，并结合超快激光加工工艺优化，实现了高深径比微孔、负锥微结构的高质高效加工，并在航天喷注部件、智能传感器中实现了应用。

自由曲面高效超精密加工装备及在位误差补偿技术

High-efficiency ultra-precision machining equipment for freeform surfaces and in-situ error compensation technology

汇报人：李增强

单位：华粹智能装备有限公司

目前，自由曲面光学元件广泛用于车载 HUD、AR/VR、空间遥感、光刻、红外成像等领域；相比球面和非球面，它可以大幅简化光学系统结构、提升成像质量。自由曲面元件可采用模压成型、磨削抛光、慢刀伺服以及快速刀具伺服等方式加工，然而上述工艺方案均存在各自局限性，无法满足高精度、高效率的批量制造需求，亟需发展高效超精密自由曲面加工新技术。华粹公司突破高动态空气静压主轴、大行程液体静压快刀伺服机构、高速多轴联动插补算法及高精度在位检测与闭环误差补偿等多项关键技术，研制出高效自由曲面超精密加工装备。该机床可完成自由曲面的超高精度加工，有效降低加工耗时，为自由曲面产品批量化高效制造提供自主可控的国产装备解决方案。

原子级精度离子束抛光装备与技术研究

Research on atomic-level precision ion beam polishing equipment and technology

汇报人：罗少卿

单位：湖南天创精工科技有限公司

集成电路、空天探测、惯性导航等前沿科技领域对光学系统性能提出了极致需求，驱动着高端光学元件制造精度迈向原子级。例如光刻领域，对极紫外光刻物镜提出了复杂曲面全频段优于300pm 的制造需求；惯导领域对核心元件半球谐振子提出了亚毫赫兹频率裂解要求。离子束抛光技术已被公认为是目前加工精度最高的光学镜面修形技术。通过对原子级精度离子束装备研发，可以解决高端光学元件如极紫外光刻物镜、半球谐振子、掩模基板等原子级制造需求，研制的装备与通用工艺可以辐射至晶圆修调等芯片关键制造工艺中。

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02 量子信息技术论坛
International Forum on Quantum Information Technology

Towards Long-distance Quantum Communication with Semiconductor Single Photon Sources
Fei Ding

Multiphoton Quantum Plasmonics
Chenglong You

Engineering/Industrializing the Core Enabling Equipment for Scaling Up Superconducting Quantum Computing: Implementation and Challenges
Ming Wu

Programmable Chiral Entanglement Routing in a Multi-Giant-Atom Waveguide
Dong Yan

Non-Equilibrium Quantum Many-body Dynamics for Signal Processing
Abolfazl Bayat

Path-Unbalanced Interferometers beyond Coherence Length
Z. Y. Jeff Ou

Free-Space Twin-Field Quantum Key Distribution towards Satellite-based Quantum Network
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Quantum-Enhanced Sensing of Excited-State Dynamics with Correlated Light
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Hybrid Quantum–Classical AI for Affective Computing: Compact Variational Quantum Circuits for Multimodal Emotion Recognition in Conversation
Bruce Gu

A Fiber Array Architecture for Scalable Neutral-Atom Quantum Computing
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Probing Real-time Lattice Gauge Theory Scattering Dynamics and Many-body Non-Hermitian Phase Transition in a Rydberg-atom Array
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Universal Logical Operations and Quantum Error Detection in Silicon
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Hamiltonian Engineering on Superconducting Quantum Processors: Multi-Qubit Gates and Quantum Simulation
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(Shallow) Phase Circuits for Quantum Randomness and Measurements
You Zhou

Quantum Error Correction and Quantum Sensing with Microwave Photons in Superconducting Cavity
Yuan Xu

Tianyan Quantum Computing Cloud Platform and Experimental Demonstration of Enriched Native Two-Qubit Gates
Hanyi Wang

Compact Neutral Atom Quantum Computer
Fu Zhuo

Multi-Thread Control Architecture for Continuous Operation of Atom Quantum Computing
Wenjun Zhang

QMClaw: A Scalable General-Purpose Framework for Quantum Measurement and Control
Weilong Wang

Advances and Applications of Continuous-Variable Optical Quantum Computing
Yingming Zhou

Thoughts on Security and the Cryptographic Industry in the Quantum Era
Wulu Li

Industrial Applications of Single-Photon Detectors in Quantum Information Technology
Yuqiang Fang



Fei Ding
Leibniz University Hannover, Germany

Talk title: ***Towards Long-Distance Quantum Communication with Semiconductor Single Photon Sources***

Abstract: The talk will first introduce the material and device foundations of semiconductor quantum-dot light sources. Starting from the controlled growth of quantum dots, we have developed deterministic single-photon and entangled-photon sources with high brightness, high purity, and high indistinguishability. By combining strain engineering, nanomembrane technologies, and semiconductor nanophotonic structures, key parameters such as emission wavelength and exciton fine-structure splitting can be precisely controlled. At the same time, photon extraction efficiency and light–matter interaction strength can be significantly enhanced. These advances enable quantum-dot light sources not only to achieve excellent single-device performance, but also to become compatible with on-chip photonic integration, providing essential building blocks for future large-scale quantum photonic circuits.

The main focus of the talk will be recent experimental progress in long-distance quantum communication using deterministic single-photon sources. First, we will present a field demonstration of intercity quantum key distribution using a semiconductor quantum-dot deterministic single-photon source. Secure key distribution was achieved over a deployed 79 km optical fiber link with low quantum bit error rates and high key efficiency, showing that deterministic single-photon sources can operate reliably not only in laboratory environments but also in real urban fiber networks. We will then discuss time-bin encoded quantum communication for even longer transmission distances. By integrating telecom C-band quantum dots with self-stabilized time-bin encoders, quantum key distribution over 120 km of standard optical fiber was achieved, while maintaining a quantum bit error rate below 11% for more than six hours. This demonstrates the long-term stability and practical network compatibility of true single-photon-source-based systems.

Finally, the talk will introduce an ultra-stable, low-error dynamic polarization encoding scheme. This approach enables high-fidelity manipulation of single-photon polarization states and maintains stable operation under environmental fluctuations, offering a new technical route for deploying deterministic single-photon sources in complex network conditions.

Biography: 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).



Chenglong You
University of Electronic Science and Technology of China

Talk title: ***Multiphoton Quantum Plasmonics***

Abstract: The quantum statistics of photons represent an important degree of freedom in multiphoton systems, yet their effective control has long remained challenging. This talk presents advances in multiphoton quantum plasmonics, from controlling photon statistics to exploring quantum statistical materials. Leveraging strong near-field coupling in a surface-plasmon platform, we demonstrate that nanostructures can modify photon statistics and use photon-number-resolving detection to reveal hidden multiphoton subsystems. Building on these findings, we introduce the concept of quantum statistical metacrystals, in which engineered plasmonic structures create allowed and forbidden statistical bands, enabling selective control over photon statistics. These studies highlight quantum statistics as a new degree of freedom for materials design, opening new avenues for statistical filtering, control, and novel quantum sensing technologies.

Biography: Prof. Chenglong You has long been engaged in cutting-edge interdisciplinary research in quantum optics, quantum plasmonics, and quantum precision measurement, with both theoretical and experimental expertise. He has revealed the nonclassical near-field dynamics of quantum plasmons under multiphoton excitation and achieved controllable manipulation of their quantum statistical properties. His related work has been highlighted multiple times in Nature Physics News & Views. To date, he has published more than 50 SCI papers, including more than 20 as first or corresponding author in leading international journals such as Nature、Nature Physics, and holds 3 U.S. and Chinese patents. He currently serves as a Technical Committee Member of the CLEO Conference. His honors include the OPTICA Emil Wolf Best Student Paper Award (7 recipients worldwide each year) and the NICT Research Fellowship (Japan).



Ming Wu
Shanghai Q-One Technology Co., Ltd.

Talk title: ***Engineering/Industrializing the Core Enabling Equipment for Scaling Up Superconducting Quantum Computing: Implementation and Challenges***

Abstract: This report examines how the core enabling equipment is engineered and industrialized to scale up superconducting quantum computing, along with the implementation and challenges involved. It begins with the demanding requirements that superconducting qubits place on millikelvin-level ultra-low temperatures and ultra-low-noise environments. It then identifies the engineering bottlenecks that emerge as qubit arrays scale up—limited cooling capacity, high-density wiring, and parasitic heat loads introduced by signal lines—and compares the technical routes adopted domestically and internationally. The report further discusses breakthrough directions for high-cooling-capacity, modularly scalable cryogenic systems and for cryogenic control-and-readout signal links, and closes by forecasting the trajectory toward an independent, domestically developed quantum hardware ecosystem in China.

Biography: Ming Wu received his B.Eng. and Ph.D. in Thermophysics from Xi'an Jiaotong University and is the founder and General Manager of Shanghai Q-One Technology Co., Ltd. His research focuses on cryogenics, ultra-low-temperature physics, heat and mass transfer, extremely weak signal transmission and readout, and cryocoolers. He has led and participated in 8 national/provincial major projects and more than 20 enterprise-funded R&D projects, and holds more than 30 authorized IPs. He co-drafted two national standards and has published more than 20 papers, eight of which are ESI Highly Cited Papers. As a recipient of the Special Government Allowance of the State Council, he serves on several national expert committees. His honors also include the Yung Wing Award for Science, Technology and Education, and the GE Foundation Innovation Award.



Dong Yan
Hainan Normal University

Talk title: ***Programmable Chiral Entanglement Routing in a Multi-Giant-Atom Waveguide***

Abstract: Quantum entanglement is a key resource for quantum communication, distributed quantum computing, and scalable quantum networks. This talk presents programmable chiral entanglement routing and quantum state exchange in a multi-giant-atom waveguide system. By tailoring chiral spontaneous emission and exploiting dark-state dynamics, we achieve high-fidelity, unidirectional transfer of quantum states and their associated entanglement, either sequentially or selectively. The separation between entangled atoms can be dynamically tuned, enabling robust conversion between long-range and short-range entanglement during propagation. Periodic piecewise modulation of the coupling phase enables sustained, nearly lossless back-and-forth state exchange between two spatially separated giant atoms, accompanied by periodic entanglement generation, even in the non-Markovian regime. This behavior mimics conventional braided architectures while overcoming limitations imposed by propagation delays and spatial geometry. These results highlight the potential of giant-atom systems for continuous long-distance entanglement transport and robust quantum state exchange in scalable quantum networks.

Biography: Dong Yan is a professor and doctoral supervisor at Hainan Normal University and serves as deputy dean of the College of Physics and Electronic Engineering. He holds a Ph.D. in Optics from Jilin University and has been a visiting scholar at Scuola Normale Superiore in Pisa and the University of Nottingham.

His research focuses on quantum entanglement and spin squeezing, quantum chaos and secure quantum communication, Rydberg-atom quantum correlations, and quantum optomechanics. His work has appeared in Phys. Rev. A, Phys. Rev. E, Opt. Lett., and Opt. Express. He has led projects funded by the National Natural Science Foundation of China and other national programs and has received several provincial science and technology awards.



Abolfazl Bayat
University of Electronic Science and Technology of China

Talk title: ***Non-equilibrium Quantum Many-body Dynamics for Signal Processing***

Abstract: The non-equilibrium dynamics of strongly correlated many-body systems offer a rich platform for uncovering the complex structural properties of quantum matter. A natural question arises: can such intricate dynamical behavior be exploited for machine learning tasks? In this talk, we address this question by presenting two distinct many-body-inspired quantum algorithms for signal processing and time-series forecasting. The first approach is a hybrid algorithm that integrates classical neural networks with non-equilibrium quantum dynamics for image classification on high-dimensional datasets. In this framework, classical networks are employed for feature reduction, while the quantum many-body dynamics perform classification via a support vector machine, thereby leveraging the strengths of both paradigms. The second algorithm utilizes the intrinsic dynamics of many-body systems to implement a quantum reservoir computing scheme for efficient temporal data processing. We demonstrate that this quantum reservoir is capable of accurately predicting complex time-series generated by chaotic maps, including the logistic and Henon maps. Building on this capability, we have developed a quantum reservoir predictor specifically designed to forecast realized volatility in US stock market data. Remarkably, our quantum model achieves superior predictive accuracy on unseen test data compared to classical reservoir computing methods that use comparable computational resources.

Biography: Abolfazl Bayat is currently working as a professor of Physics at the University of Electronic Science and Technology of China (UESTC). Before joining the UESTC in 2018, he was working at University College London (2008-2011 and 2013-2017) in the United Kingdom and University of Ulm (2011-2013) in Germany. His research interest includes quantum sensing, quantum simulation and quantum machine learning.



Z. Y. Jeff Ou
City University of Hong Kong

Talk title: ***Path-Unbalanced Interferometers beyond Coherence Length***

Abstract: Interferometry has been used widely in sensing application. However, the technique is limited by the finite coherence time of the light sources when the interference paths are not balanced. As is well-known, quantum interference relies on measurement processes. The aforementioned requirement of path balance is for traditional intensity measurement from one detector. In this presentation, we consider two different methods: intensity correlation measurement between two detectors and homodyne measurement with a strong local oscillator. We find that they can be used to recover interference which usually does not occur in intensity measurement by one detector. While the first method is based on two-photon coincidence measurement, the second one gives direct amplitude measurement and presents a new way of observing optical interference. We discuss various scenarios and data analysis methods to achieve interference of unbalanced delays in different paths with potential practical optical sensing applications and astronomical high-resolution imaging, and some startling implications for the fundamental Bohr's complementarity principle for which-way interference and Dirac's photon self-interference interpretation.

Biography: Professor Ou obtained his BS in 1984 from Peking University and Ph.D. in 1990 from University of Rochester. He is now a Chair Professor at the City University of Hong Kong. Professor Ou is an expert in quantum optics, especially in quantum interference, for which he is the co-inventor of the well-known Hong-Ou-Mandel interferometer. He pioneered the field of multi-photon interference, which he summarized in the monograph "Quantum Multi-Photon Interference" published by Springer in 2007. Professor Ou's current research focuses on quantum metrology, quantum sensing, quantum state engineering, quantum information and communication, and more fundamental quantum measurement and quantum coherence problems. Professor Ou is an Associate Editor of Optica Quantum and a Fellow of the American Physical Society, the Physical Society of Hong Kong, and Optica (formerly the Optical Society of America).

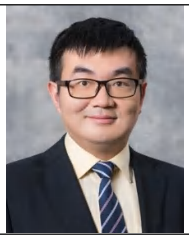


Yu-Huai Li
University of Science and Technology of China

Talk title: ***Free-Space Twin-Field Quantum Key Distribution towards Satellite-based Quantum Network***

Abstract: Twin-field quantum key distribution (TF-QKD) elevates the secure key rate from a linear to a square-root dependence on channel loss while preserving measurement-device-independent security. This protocol is uniquely positioned to enable global-scale quantum networks, even under extreme channel loss. While fiber-based TF-QKD implementations have advanced rapidly since its proposal, free-space realizations have remained elusive due to atmospheric turbulence-induced phase distortions. Here, we report the first experimental demonstration of free-space TF-QKD over 14.2 km urban atmospheric channels, surpassing the effective atmospheric thickness – a critical threshold for satellite compatibility. We achieve a secret key rate exceeding the repeaterless capacity bound, a milestone for practical quantum communication. Our approach eliminates the need for an auxiliary channel to stabilize a closed interferometer, instead leveraging open-channel time and phase control of optical pulses. This work represents a pivotal advance toward satellite-based global quantum networks, combining high-speed key distribution with inherent resistance to real-world channel fluctuations.

Biography: Yu-Huai Li is an Associate Professor at the University of Science and Technology of China (USTC), where he earned his Ph.D. in Physics in 2017. His research focuses on quantum entanglement, quantum communication, large-scale quantum optical interference in free space, and quantum computation. His work was awarded the Newcomb Cleveland Prize from the American Association for the Advancement of Science (AAAS) and was selected as one of the Physics World Top Ten Breakthroughs of the Year.



Zhedong Zhang
City University of Hong Kong

Talk title: ***Quantum-Enhanced Sensing of Excited-State Dynamics with Correlated Light***

Abstract: Quantum-entangled photons, e.g., entanglement and squeezing, open up a new avenue for molecular spectroscopy and sensing, by using parameters of the quantum-light correlations as new control knobs. In this talk, I will present an overview of recent advancements on nonlinear optical spectroscopy for molecular relaxation dynamics, using quantum-correlated photons. This led to the engagement of the quantum optics with the ultrafast spectroscopy, which draw great attention recently. The entangled twin photons and squeezed light will be of the most interest, with a focus on the time-resolved scheme. The pump-probe spectra and quantum ghost spectroscopy with broadband quantum light are studied, where the microscopic models are developed for a real-time monitoring of electron dynamics. Our results reveal an incredible selectivity of accessing the molecular correlation function, e.g., suppression of ground-state bleaching and a time-frequency scale beyond the Fourier's limitations, which therefore present a quantum supremacy in ultrafast spectroscopy.

Biography: Prof. Zhedong Zhang is an Associate Professor at City University of Hong Kong. He obtained his Ph.D. in physics from Stony Brook University in 2016. Since then, he has been working as a postdoctoral fellow until 2020 when he moved to Hong Kong. He received the Robert Welch Postdoctoral Fellowship (Chemical Physics) in 2020. In 2024, he received the Excellent Young Scientists Award, NSFC.

Prof. Zhang's research interest is the theoretical chemical physics, with two focuses: (1) Nonlinear optical spectroscopy with quantum light for ultrafast processes in molecules; (2) Mesoscopic quantum thermodynamics for systems driven far from equilibrium. He has more than 40 professional publications, on high-profile journals including Nature, Phys. Rev. Lett., Optica, J. Phys. Chem. Lett., etc.



Bruce Gu
National Supercomputer Center in Jinan;
Qilu University of Technology (Shandong Academy of Sciences)

Talk title: ***Hybrid Quantum–Classical AI for Affective Computing: Compact Variational Quantum Circuits for Multimodal Emotion Recognition in Conversation***

Abstract: Hybrid quantum–classical AI embeds compact variational quantum circuits (VQCs) into classical deep-learning pipelines as small, structured, nonlinear modules suited to near-term quantum devices. This talk asks when such modules genuinely help, using multimodal emotion recognition in conversation as a test case, where text and speech must be fused under severe label imbalance without fine-tuning large pretrained encoders. We present Q-CTRLNet, which couples frozen BERT and HuBERT encoders and bidirectional cross-modal attention with a dual-path decision stage: a classical auxiliary classifier and a seven-qubit PrunedVQC with only nine trainable parameters. A Control Supervision Mechanism injects minority-class and hard-sample signals into selected quantum input angles, and a differential learning-rate strategy keeps the tiny quantum branch trainable. On MELD and IEMOCAP, Q-CTRLNet reaches 66.1% and 65.4% accuracy, with gains concentrated on minority emotions. Ablations, compact classical replacements and quantum probe analysis show that the quantum branch outperforms equally small classical modules and produces class-dependent responses. We close with design lessons for hybrid quantum AI and open directions toward noise-aware, hardware-level validation.

Biography: Bruce Gu is a Professor at the National Supercomputing Center in Jinan and a Doctoral Supervisor at Qilu University of Technology (Shandong Academy of Sciences), Jinan, China, as well as Chief Scientist of Hangzhou Penguin Technology. He was a Research Fellow at the University of Technology Sydney, following doctoral research at Deakin University. His research centers on LLMs, quantum computing for AI, privacy-preserving computing, federated learning, and edge/fog intelligence, with real-world deployment in smart city, smart campus, and IoT infrastructure. He has over 50 publications in high-quality journals and conferences, including TII, IoTJ, PR, TSG, and BDMA. Bridging academia and industry, he has led multiple industry–academia collaboration projects, translating research into commercial AI products for smart education, intelligent recruitment, and enterprise digitalization, in partnership with governments, universities, and enterprises. He has served as General Co-Chair, TPC Chair, and TPC Member for numerous international conferences, and as a reviewer for many top-tier journals.



Peng Xu
Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences

Talk title: ***A Fiber Array Architecture for Scalable Neutral-Atom Quantum Computing***

Abstract: Arrays of single atoms trapped in optical tweezers are a promising platform for scalable quantum computing, but achieving highly parallel gate operations remains challenging. Here, we realize a fiber array architecture for fully independent atom control. By emitting trapping and addressing lasers from the same waveguide, this design ensures spatial alignment and suppresses noise. We trap 10 atoms in a 2D array, achieving single-qubit gates (fidelity 0.9966), simultaneous arbitrary gates on four qubits (0.9961), and clear Rydberg blockade. Additionally, this architecture facilitates fast, coherent qubit transfer via shortcuts-to-adiabaticity. We achieve ultrafast in situ transfer (10 μs, fidelity 0.99992) and inter-site transfer (120 μs, fidelity 0.9998), alongside a model for optimizing large-scale transfer. Combined, these results show the fiber array architecture provides a robust path for scalable neutral atom quantum processors, supporting both high-fidelity parallel gates and rapid connectivity.

Biography: Prof. Peng Xu's research activities are focused on experimental studies of quantum computing with single-atom arrays trapped by optical tweezers. His representative work includes the preparation of heteronuclear single-atom arrays, the realization of quantum gates with heteronuclear atom pairs, high-precision manipulation of both internal and external states of heteronuclear atoms, and so on. These results are published on Science, Phys. Rev. Lett., Nat. Commun and et.al. He has led multiple national-level projects, such as the National Key R&D Program (2021YFA1402000) and the Young Scientist Project of the Key R&D Program (2016YFA0302800). In 2017, he was selected for the Youth Innovation Promotion Association of the Chinese Academy of Sciences and was recognized as an outstanding member in 2021. He has been supported by the national youth talent program in 2022.



Lin Li
Huazhong University of Science and Technology

Talk title: ***Probing Real-time Lattice Gauge Theory Scattering Dynamics and Many-body Non-Hermitian Phase Transition in a Rydberg-atom Array***

Abstract: Rydberg atom arrays, featuring controllable interactions and programmable spatial configurations, have emerged as an ideal platform for exploring many-body quantum dynamics. In this talk, I will present our group's recent experimental progress on lattice gauge theories and many-body non-Hermitian systems based on Rydberg atom array: 1.We have mapped a U(1) lattice gauge theory onto a Rydberg atom system. In this architecture, we not only captured the real-time dynamics of quasi-elastic scattering between mesons, but also observed a "dynamical freezing" phenomenon in non-equilibrium many-body systems during particle collisions via a double-quench protocol. 2.We constructed a non-Hermitian XY model with fully tunable parameters. By introducing engineered dissipation, we observed an interaction-driven many-body non-Hermitian phase transition alongside a novel non-Hermitian many-body blockade effect. Protected by this mechanism, quantum states exhibit remarkable robustness against dissipative decay within the vast many-body Hilbert space, and their survival probability displays non-monotonic oscillations as a function of system size.

Biography: Lin Li is a Professor at Huazhong University of Science and Technology. Lin's research focuses on quantum information processing based on Rydberg atoms. Lin obtained his bachelor's degree from Nankai University in 2010 and completed his Ph.D. at the University of Michigan in 2016. From 2016 to 2018, he conducted postdoctoral research at the Max Planck Institute for Quantum Optics in Germany. In September 2018, he joined Huazhong University of Science and Technology and started his research group, focusing on Rydberg atoms. Lin's works in the field of Rydberg atoms include the realization of many-body Rabi oscillations based on Rydberg atoms, entanglement between Rydberg atoms and photons, long-coherence time Rydberg quantum storage, high-quality Rydberg single-photon sources, high-fidelity quantum operations such as quantum logic gate, entanglement filter, and nonlocal single-photon transistor.



Yu He
International Quantum Academy (Shenzhen International Quantum Academy / Hefei National Laboratory)

Talk title: ***Universal Logical Operations and Quantum Error Detection in Silicon***

Abstract: Silicon-based quantum computing has emerged as a highly promising platform within the broader landscape of quantum information systems. Here, I will present two recent experimental works towards fault-tolerant quantum computing. The first is the demonstration of a four-qubit error-detection circuit with stabilizers to detect arbitrary single-qubit errors in the [[2,0,2]] code. Second is the demonstration of the complete set of universal logical quantum operations on a silicon-based processor. Encoding two logical qubits across five phosphorus nuclear spins using the [[4,2,2]] code, we achieved fault-tolerant logical state preparation, logical single-qubit and two-qubit entangling gates, and, critically, a logical non-Clifford T gate. We also implemented a variational quantum eigensolver to simulate the ground-state electronic structure of the water molecule, providing a prototypical validation of logical quantum computation. I will conclude by discussing future research on this platform, exploring the engineering challenges and strategic opportunities for large-scale integrated quantum processors.

Biography: Yu He is a researcher at the Shenzhen International Quantum Academy / Hefei National Laboratory. His primary research interests include semiconductor quantum computing, quantum simulation, and atomic quantum chips. He is the PI of the atomic-based silicon quantum computing team. He was listed in the MIT Technology Review Innovators Under 35. He has led multiple projects funded by the National Natural Science Foundation of China, the Ministry of Science and Technology, and local governments. He is a member of the standing council of the Guangdong Physical Society. His work has been selected as one of the "Top 10 Quantum Computing Experiments of 2019" and as one of the "Top 10 Scientific and Technological Advances in China in 2017." He has published a total of 30 SCI papers, with over 6,000 total citations and an H-index of 23.



Kai Xu
Institute of Physics, Chinese Academy of Sciences

Talk title: ***Hamiltonian Engineering on Superconducting Quantum Processors: Multi-Qubit Gates and Quantum Simulation***

Abstract: Quantum simulation, first envisioned by Feynman in 1981, is among the most promising applications of quantum computing, and superconducting qubits provide a powerful platform for implementing programmable quantum simulators, where engineering effective Hamiltonians is central to realizing complex many-body physics. In this talk, I will present our recent progress in Hamiltonian engineering on superconducting quantum processors, covering both multi-qubit gates and quantum simulation experiments.

On the gate side, we propose and experimentally demonstrate a direct implementation of a scalable three-qubit controlled-controlled-Z (CCZ) gate based on a nearest-neighbor tunable-coupling architecture, achieving high process fidelity and simplifying the circuit resources required for quantum algorithms (PRL 135, 050602 (2025), cover article). We also develop high-fidelity qubit readout and fast unconditional reset techniques (PRL, editor's suggestion).

On the simulation side, we engineer a specially designed 78-qubit superconducting chip ("Zhuangzi 2.0") in a two-dimensional square-lattice geometry with tunable couplers, and implement random multipolar driving to realize a controllable prethermalization platform. We quantitatively verify the prethermalization lifetime and the scaling behavior of entanglement entropy, entering a regime beyond classical simulation (Nature 650, 79 (2026)). We further demonstrate the quantum Mpemba effect with flexible modulation on an all-to-all coupled architecture (PRL 137, 010402 (2026)), observe spontaneous symmetry breaking in the LMG model (PRL 134, 150406 (2025)), and explore Thouless pumping with the interplay between disorder and topology (Nat. Commun. 16, 108 (2025)).

Finally, I will discuss our perspectives on scalable control, synthesis of more complex many-body models, and the pathway toward practically useful quantum advantage.

Biography: Kai Xu received his B.S. degree from Central South University in 2012 and his Ph.D. degree in Physics from Zhejiang University in 2018. He is currently an Associate Professor at the Institute of Physics, Chinese Academy of Sciences (IOP-CAS), where he leads the experimental measurement and control effort for

superconducting quantum computing. His research focuses on superconducting quantum computing and quantum simulation, including multi-qubit entanglement, quantum logic gates, and simulation of complex many-body systems.

He has published more than 50 SCI papers, with about 30 as first or corresponding author, including one Nature, one Science, and ten Physical Review Letters. His works include the 10-qubit and 20-qubit entanglement records in superconducting systems, and the 78-qubit prethermalization simulation published in Nature (2026). He is a recipient of the National Science Fund for Excellent Young Scholars (Youth Category B) and the Beijing Science and Technology New Star program.



Xi-Lin Wang
Nanjing University

Talk title: ***OAM-based Cavity-enhanced Narrow-band Entangled Source and Heralded High-dimensional Photon-Photon Gate***

Abstract: Orbital angular momentum (OAM) inherently possesses high-dimensional characteristics, rendering it highly valuable for quantum information processing. This report presents two recent studies from our group based on OAM. First, by exploiting OAM-degenerate cavity-enhanced spontaneous parametric down-conversion, we have achieved, for the first time, a narrow-band entangled photon source without post-selection [Phys. Rev. Lett. 134, 053801 (2025)], which injects new momentum into research on long-lived quantum memories and holds promise for novel applications in enhanced light–matter cavity interactions. Second, leveraging four-dimensional OAM encoding and ancillary photons, we have realized a four-dimensional controlled-phase flip gate for photons [Nature Photonics (2026)], an operation that would require at least 13 two-qubit entangled gates under the conventional two-dimensional qubit decomposition framework.

Biography: WANG Xi-Lin, Professor at Nanjing University, recipient of the National Excellent Young Scientist Fund, and selected for the Jiangsu Provincial "Innovation and Entrepreneurship Talent" program. He has long been systematically engaged in research on the manipulation and applications of structured light fields, achieving a transition from classical to quantum regimes. As first/corresponding author, he has published over 20 papers in prestigious journals including Nature (1), Nature Photonics (1), PRL (7), and Optica (4). His research outcomes have been recognized as an "International Physics Breakthrough of the Year," and have been selected among the "Top 10 Scientific and Technological Advances in China" and the "Top 10 Scientific Advances in China," among others. He has published a total of over 50 papers, with more than 4,500 SCI citations. He is the recipient of the First Prize of the Rao Yutai Prize in Fundamental Optics awarded by the Chinese Optical Society.



Xin-You Lü
Huazhong University of Science and Technology

Talk title: ***Disorder Induced Intriguing Quantum Effects in Waveguide QED***

Abstract: In this presentation, I will introduce our recent works in the field of waveguide quantum electrodynamics (QED). We investigated the disorder induced intriguing quantum effects, including the strong photon antibunching and the exponential scaling of subradiant decay rates. Our work not only resolves the critical role of disorder in modifying photon statistics and collective emission but also bridges the gap between radiative phenomena and disorder-induced localization physics.

Biography: Xin-You Lü is a professor and doctoral supervisor at the School of Physics, Huazhong University of Science and Technology. He is an awardee of the National Science Fund for Distinguished Young Scholars, the Excellent Young Scientists Fund of the National Natural Science Foundation of China, and the Hubei Provincial 100 Talents Program. His research focuses on quantum physics and quantum information, particularly on theoretical studies in cavity quantum electrodynamics (QED).



Pengbo Li
Xi'an Jiaotong University

Talk title: ***Superconducting Qubit Based on Altermagnets***

Abstract: We exploit the Josephson effect in superconductor-altermagnet-superconductor junctions and show how to engineer prescribed current-phase relations by device design. Based on these programmable Josephson potentials utilizing altermagnetism, we propose a new class of superconducting qubits that combine large anharmonicity with enhanced robustness against decoherence via coherent two-Cooper-pair tunneling. We show that in the 2ϕ-junction regime, this kind of qubit is intrinsically protected against both charge and flux noise due to parity protection. Magnetic flux can be used to precisely control the qubit and, under appropriate bias, this architecture further suppresses charge and flux noise. Our results establish altermagnets as a versatile platform for Josephson-potential engineering and open a new route toward high-performance superconducting qubits combining high coherence, large anharmonicity, and broad tunability.

Biography: Peng-Bo Li is a Professor at the School of Physics and Deputy Director of the Institute of Quantum Science and Technology at Xi' an Jiaotong University. He obtained his Ph.D. from Peking University in 2009. His research interests lie in theoretical quantum optics and quantum information, with a particular focus on the theory of hybrid quantum systems involving solid-state qubits, nanomechanical systems, and quantum magnonics. He is an Editorial Board member of Physical Review Research, a member of the Quantum Optics Committee of the Chinese Physical Society, a member of the Optical Quantum Science and Technology Committee of the Chinese Optical Society, and a Council Member of the Shaanxi Physical Society.



Yi-Pu Wang
Zhejiang University

Talk title: ***Transverse-Spin Control of Chiral Magnon–Photon Interactions***

Abstract: Directional light–matter coupling is a key resource for nonreciprocal and spin-selective devices. In this talk, I will present two experiments that use the transverse spin of engineered microwave surface waves to control magnon–photon interactions. First, magnons in a yttrium iron garnet (YIG) sphere are coupled to spin–momentum-locked spoof surface plasmon polaritons. Spin matching selects a single propagation direction and suppresses reflection. Under critical coupling, transmission also vanishes, yielding unidirectional perfect absorption. Adding magnetic resonators further enables bidirectional and multiband absorption. Second, a composite right-/left-handed transmission-line metamaterial realizes spin–refractive-index locking, in which the transverse spin reverses with the sign of the effective refractive index for a fixed energy-flow direction. Coupling this structure to a YIG sphere allows the chiral coupling direction to be switched by frequency, enabling frequency-division routing and reconfigurable nonreciprocal signal flow. Together, these results identify transverse-spin and dispersion engineering as a unified route to programmable magnon–photon interfaces and compact microwave devices.

Biography: Yi-Pu Wang received his B.Sc. from Tongji University in 2013 and his Ph.D. from the China Academy of Engineering Physics in 2018. After postdoctoral research at the University of Manitoba, he joined Zhejiang University in 2020. His research spans cavity magnonics, non-Hermitian physics, hybrid quantum systems, and artificial electromagnetic structures. He has published 1 paper in Nature Physics, 9 in Physical Review Letters, 8 in Nature Communications, and 1 in Science Advances. His publications have received more than 5,000 citations in total. He was selected for the 2023 Changjiang Young Scholar cohort and received the Zhejiang Provincial Outstanding Young Scientist Fund in 2025.



Xiao Yuan
Center on Frontiers of Computing Studies, Peking University

Talk title: ***Distributed Resource Theory of Entanglement and Magic***

Abstract: In distributed fault-tolerant quantum computing, entanglement and magic are essential resources for quantum communication and universal fault-tolerant computation, respectively. Although they are usually treated as distinct resource currencies, whether they admit a unified resource-theoretic description remains an open question. Here, we introduce the distributed resource theory of entanglement and magic (DREAM). In this framework, the free states are convex mixtures of product local stabilizer states, and the free operations are local stabilizer circuits assisted by classical communication (LSCC). We show that DREAM contains nontrivial resource states that are neither entanglement nor magic, so it is strictly richer than treating the two resources independently. Surprisingly, such resources can enable the teleportation of magic states between distant parties without consuming entanglement, revealing a counterintuitive form of resource teleportation mediated entirely by separable states. We further generalize this result to quantum networks and investigate general quantum-state teleportation under LSCC. We show that the shared resource under DREAM is closely related to the teleportation capability, quantified by the magic of the teleported state. Our work establish a systematic framework for studying distributed quantum resources and uncover intrinsic relations among distinct resources within a unified resource theory.

Biography: Dr. Xiao Yuan received his B.S. in Physics from Peking University in 2012 and his Ph.D. in Physics from Tsinghua University in 2016. He served as an Assistant Researcher at the University of Science and Technology of China in 2017, then conducted postdoctoral research at the University of Oxford (2017–2019) and at Stanford University (2019–2020). He is currently an Assistant Professor at the Center on Frontiers of Computing Studies, Peking University. His research interests include quantum computing algorithms and applications of quantum computing in chemistry.



Qi Zhao
Department of Computer Science, The University of Hong Kong

Talk title: ***Quantum Advantage in Simulating Quantum Dynamics***

Abstract: Quantum simulation is a central application of quantum computing. However, turning the ability to represent and manipulate quantum systems into physically meaningful answers beyond the reach of classical computation, and at an affordable cost, requires a systematic understanding of simulation errors, algorithmic efficiency, and computational tasks. This report addresses the question of how quantum resources affect simulation efficiency and how they may ultimately translate into computational advantage. We first discuss the roles of entanglement and non-stabilizerness in quantum simulation, showing how these resources, which are closely related to the hardness of classical simulation, can under suitable conditions improve error bounds and the statistical stability of error distributions in digital quantum simulation. We then present methods for designing efficient algorithms by exploiting observable structures, error interference, and open-system dynamics, illustrating how physical structure can be converted into savings in computational resources. Finally, using dynamical quantum phase transitions and fault-tolerant many-body dynamics simulations as examples, we examine the task boundaries and practical conditions for quantum advantage from the perspectives of computational complexity and concrete resource estimation. Together, these studies connect quantum resources, algorithmic performance, and computational advantage, offering new insights into the realization of efficient quantum computing for physics-oriented problems.

Biography: Prof. Qi Zhao is an Assistant Professor in the Department of Computer Science, the University of Hong Kong (HKU). In 2024, he was recognized as one of the MIT Technology Review "Innovators Under 35" for the Asia Pacific Region. His research interests include quantum simulation, quantum computing, quantum information, and entanglement detection. He obtained his bachelor's and Doctoral degree from Tsinghua University in 2014 and 2018, respectively. He was a postdoctoral researcher at the University of Science and Technology of China in 2019. He was a Hartree Postdoctoral Fellow at the University of Maryland in the United States before joining HKU as an Assistant Professor in 2022. He has published more than 60 journal articles, including Nature, Nature Physics, Nature Communications, Science Advances, PRL, PRX, npj Quantum Information, PNAS, and IEEE TIT. His works have also been presented as contributed talks at important conferences in quantum information theory, such as QIP, AQIS, TQC, and QCrypt.

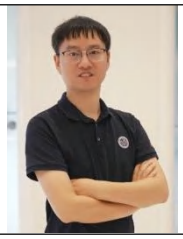


You Zhou
School of Future Information Technologies, Fudan University

Talk title: ***(Shallow) Phase Circuits for Quantum Randomness and Measurements***

Abstract: High-quality quantum randomness and randomized measurements are usually associated with deep random circuits and extensive scrambling, creating a bottleneck as quantum processors scale. I will present a low-resource route based on structured, sparse phase circuits. First, Robust Phase Shadows (RPS; arXiv:2507.13237) use controlled-Z as the only entangling gate and enable robust and efficient estimation of global quantum properties under realistic noise. Second, Shallow Phase Shadows (SPS; arXiv:2609.10408) show that a sparse Clifford-IQP ensemble, although not itself a relative-error design, can still achieve constant-depth global stabilizer-fidelity estimation through a second-look strategy. Finally, sparse commuting Clifford phase layers combined with local Clifford gates generate approximate quantum projective designs in relative error with logarithmic interaction degree and constant adaptive depth (arXiv:2609.03925). Together, these results connect randomized measurement, shadow estimation, verification, and quantum randomness generation.

Biography: You Zhou earned a B.S. in Electronic Science and Technology from Zhejiang University (2014) and a Ph.D. in Physics from Tsinghua University (2019). Before joining Fudan University in 2022, he conducted visiting and postdoctoral research at USTC, Harvard, NUS, and NTU. He is currently an Assistant Professor at Fudan University's School of Future Information Technologies. His research spans quantum correlations and complexity, quantum measurement and calibration, and quantum simulation. He leads NSFC General Program and Young Scientists Fund (Category C) projects and other national and provincial projects. His work has appeared in Nature Physics, Physical Review Letters, PRX Quantum, and npj Quantum Information. He has presented at QIP and AQIS, serves on PRL's Early Career Advisory Board, has served three times on the AQIS Program Committee, and co-organized IWQCVV (2023 and 2025).

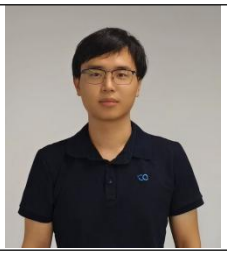


Yuan Xu
Shenzhen International Quantum Academy

Talk title: ***Quantum Error Correction and Quantum Sensing with Microwave Photons in Superconducting Cavity***

Abstract: In superconducting quantum circuit systems, nonclassical microwave photonic states in superconducting cavities can be used to realize hardware-efficient quantum information encoding and quantum error correction, and they also offer advantages for quantum sensing and high-precision measurements. In this talk, I will present our recent researches in these two areas. For quantum error correction, we have implemented both real-time measurement-based and autonomous quantum error correction for a binomially encoded logical qubit, extending the qubit coherence lifetime beyond the break-even point in this system. For quantum metrology, we have realized efficient generation of large Fock states and squeezed states, and demonstrated the advantages of quantum-enhanced sensing using these nonclassical resource states. These research efforts are expected to further promote the potential application and development of quantum technologies.

Biography: Dr. Yuan Xu is currently a Researcher at Shenzhen International Quantum Academy. He received his bachelor's degree in physics from Xi'an Jiaotong University in 2013 and his Ph.D. in physics from Tsinghua University in 2019. Subsequently, he joined Southern University of Science and Technology, and then moved to Shenzhen International Quantum Academy since 2023. His research interests include quantum control, quantum optics, quantum error correction, and quantum metrology with superconducting quantum circuits. He has published over 40 SCI-indexed academic papers in Nature, Nature Physics, Nature Communications, Physical Review Letters, Optica, and other journals. His research achievement was selected as one of the "Top ten Scientific Advances in China 2023."



Hanyi Wang
China Telecom Quantum Group

Talk title: ***Tianyan Quantum Computing Cloud Platform and Experimental Demonstration of Enriched Native Two-Qubit Gates***

Abstract: The Tianyan Quantum Computing Cloud Platform provides an integrated environment that connects quantum processors, high-performance classical computing resources, simulators, and a unified software toolchain for compilation, calibration, hybrid scheduling, and application development. By integrating heterogeneous computing resources with automated control and low-latency quantum–classical coordination, the platform provides infrastructure for scalable quantum experiments and hybrid quantum–classical computing.

In this report, we also present an experimental implementation of enriched native two-qubit gates based on the AshN interaction on a superconducting quantum processor with the same hardware architecture as Zuchongzhi 3.0, comprising 105 frequency-tunable transmon qubits and 182 tunable couplers. The AshN framework enables a broad family of native two-qubit operations beyond the conventional CZ gate set, providing additional flexibility for quantum circuit compilation and reducing the overhead associated with limited hardware connectivity. Experimental demonstrations using benchmark circuits and multipartite quantum-state preparation show that enriched native gates can improve circuit efficiency and overall execution performance.

Biography: Hanyi Wang, Ph.D., is a Senior Expert and Quantum Computing Researcher at China Telecom Quantum Group. He received his Ph.D. from the University of Science and Technology of China. His research interests include quantum simulation with ultracold neutral atoms in optical lattices, quantum computing, and quantum control of superconducting qubits. He has published ten research papers in leading journals, including Nature, Science, Nature Physics, Physical Review X, and Physical Review Letters.



Fu Zhuo
CAS Cold Atom Technology (Wuhan) Co., Ltd.

Talk title: ***Compact Neutral Atom Quantum Computer***

Abstract: Single-atom arrays trapped in optical tweezers have emerged as one of the leading platforms for quantum computing, owing to their favorable scalability and excellent inter-qubit connectivity. However, the vast majority of current atomic array systems are still constructed on laboratory optical tables, featuring large footprints and long optical paths. Consequently, they face substantial challenges in the control of environmental parameters—including electric fields, magnetic fields, temperature, and mechanical vibrations—as well as in long-term optical-path stability, making stable operation outside laboratory environments difficult. Here, we demonstrate a rack-integrated neutral atom quantum processor. Through an integrated design, the processor achieves a significantly reduced system footprint and enhanced stability in environmental parameter control. Meanwhile, benefiting from the shortened optical path, its beam pointing remains stable over extended operation. These features collectively enable long-term stable operation of the processor with minimal manual intervention. On this processor, we perform microwave global operations on 200 Rb atoms, achieving a global single-qubit gate fidelity of 0.99977(5), and an average fidelity of 0.99(1) for the parallel execution of four pairs of two-qubit CZ gates. These results demonstrate that the integrated processor has reached a performance level comparable to conventional laboratory platforms, laying a foundation for the engineering and practical deployment of neutral-atom quantum computing systems.

Biography: Fu Zhuo studied Applied Physics at Chongqing University and conducted graduate research at the Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, under Prof. Mingsheng Zhan, focusing on neutral-atom quantum computing. During his PhD, he independently designed and built a neutral-atom Rydberg excitation platform and, using a novel controlled-phase gate scheme, achieved two-atom entanglement with a fidelity of 0.98—a world-leading result at the time. In 2022, he received the title of Outstanding Doctoral Graduate of the Innovation Academy and had published five SCI papers as first or corresponding author. He later joined CAS Coldatom Technology (Wuhan) Co., Ltd. as R&D Director of Quantum Computing, leading the development of full-system neutral-atom quantum computers. In 2024, he and his team developed "Hanyuan-1," China's first commercial atomic-system quantum computer, enabling multiple commercial deliveries; it was

recognized as an MIIT 2024 Outstanding Case for Future Industry Innovation and Development, selected for Hubei's 2025 "61020" Science and Technology Innovation Achievements. He leads Wuhan's key technology program for a 1,000-qubit quantum computing system and MIIT's 2025 "Unveiling the List and Taking the Lead" project on "Quantum Error Correction Coding" and a Hubei provincial science and technology innovation project, while serving as a core member of Hubei's major R&D program on the development and application of atomic quantum computers. He holds seven granted invention patents and serves as a council member of the Hubei Quantum Information Science Society.



Wenjun Zhang
Qosmos Technology Co., Ltd.

Talk title: ***Multi-Thread Control Architecture for Continuous Operation of Atom Quantum Computing***

Abstract: This report summarizes recent progress by our team in neutral-atom quantum computing. Using our first-generation prototype, we validated system reliability through Kibble–Zurek phase-transition experiments and high-fidelity single-/two-qubit gate operations.

Leveraging these milestones, Qosmos is developing a commercial-grade, cloud-accessible quantum system set for release in April 2027, featuring upgraded architecture and market-ready hardware (e.g., high-speed DDS, precision current sources, atom sources, and integrated photonics). Concurrently, we are pursuing next-generation technologies — such as metasurface optical tweezers, optical cavity-assisted readout, and AI-driven automated control—to enhance throughput and scalability.

Biography: Wenjun Zhang received his Ph.D. from Tsinghua University in 2026. During his doctoral studies at the department of physics, Tsinghua University, he focused on experimental research in neutral-atom quantum computing and led the development of both the first- and second-generation atomic quantum computing platforms. His research has been published in high-profile journals including Physical Review Letters and npj Quantum Information. He is currently the Chief Technology Officer (CTO) of Qosmos (Beijing) Technology Co., Ltd.



Weilong Wang
Information Engineering University

Talk title: ***QMClaw: A Scalable General-purpose Framework for Quantum Measurement and Control***

Abstract: As quantum computing continues to scale, quantum measurement and control (QMC) are increasingly constrained by calibration workflow complexity and by requirements for low-latency execution, robust exception handling, and traceable workflow governance. Existing frameworks for QMC are specialized and task-specific, while language-model-based agents for QMC suffer from excessive latency and cannot satisfy the strict timing and control-density demands of large-scale quantum systems. Here we propose QMClaw, a general, workflow-oriented framework for QMC built, featuring a local-first, tool-governed, robust architecture. At its core is a RuleEngine-centered control layer that processes structured context, performs rule-based state transitions, and generates execution plans for typical calibration workflows. Language models are used only for natural-language interaction, high-level task understanding, and exception support, keeping the critical fast path efficient. We implement a single-qubit tune-up workflow as a demonstration and validation using real quantum device dataset. We also prove that the framework achieves quantitatively acceptable levels in terms of resource cost, LLM calling times and decision latency, enabling its practical deployment in large-scale quantum qubit measurement and control scenarios. This work presents a general workflow-oriented framework for QMC and provides evidence that rule-centered architectures are a promising design choice for scalable quantum-system calibration.

Biography: Weilong Wang received undergraduate training in Physics from Peking University and got a Ph.D. from University of Vigo (Spain) in 2019, now works as a lecturer at Information Engineering University. At present, he is mainly engaged in the research of the design and calibration of superconducting quantum chips and quantum key distribution. In recent years, he has published more than 35 SCI academic papers in PRL, npj Computational Materials, PR Applied, Supercond. Sci. Technol and other journals. He is responsible for Key Program of the National Natural Science Foundation of China and other projects.



Yingming Zhou
Shanghai Xiwei Quantech Co., Ltd.

Talk title: ***Advances and Applications of Continuous-Variable Optical Quantum Computing †***

Abstract: Continuous-variable (CV) optical quantum computing, which employs squeezed states as the core quantum resource, represents one of the leading approaches toward fault-tolerant universal quantum computing. Compared with discrete-variable architectures such as superconducting qubits, the CV route enables deterministic preparation of squeezed states and efficient homodyne detection, with the main optical system operating at room temperature. It can also leverage the mature optoelectronics, silicon photonics, and fiber-optic interconnect supply chain, offering distinct advantages in scalable manufacturing and engineering deployment. In recent years, milestones exemplified by Xanadu's Borealis and Aurora have demonstrated quantum computational advantage and preliminary error-correction demonstrations, driving the rapid advancement of CV optical quantum computing technology. This paper systematically reviews key technological advances in CV optical quantum computing, including high-squeezing squeezed-light sources, GKP state preparation, photonic integration, and real-time feed-forward error correction, and discusses emerging application scenarios in financial risk control, molecular analysis, and scientific computing.

Biography: Yingming Zhou holds a master's degree from Shanghai Jiao Tong University. He is the General Manager of Xiwei Zhiyuan Quantech, overseeing the company's strategic planning, team building, product R&D, and market expansion. He currently serves as a director of the Quantum Information Network Industry Alliance. Mr. Zhou has received numerous accolades, including the 2024 Minhang District Youth Innovation Talent Award, the 2024 Daling Bay Innovation and Entrepreneurship Entrepreneur Award, and recognition on the 2024 Yangtze River Delta G60 Science and Innovation Corridor U30 Youth Entrepreneurship List and the "Star G60" Entrepreneurship Talent List. He was also shortlisted for the "2024 Shanghai Top Ten Youth Science and Technology Entrepreneurship Pioneers."



Wulu Li
Changchun Jilin University Zhengyuan Information Technologies Co., Ltd.

Talk title: ***Thoughts on Security and the Cryptographic Industry in the Quantum Era***

Abstract: This talk begins with a brief overview of advances in quantum computing and quantum communication, the technical approaches to countering quantum threats, and the main international developments in post-quantum cryptography migration. It then discusses the key characteristics of quantum key distribution (QKD), the challenges involved in its industrialization, and Jilin University Zhengyuan's accomplishments and accumulated experience in QKD-related technologies and industrial applications. It concludes by outlining integrated concepts and solutions for combining QKD and post-quantum cryptography (PQC).

Biography: Dr. Wulu Li received his Ph.D. in Pure Mathematics from the School of Mathematical Sciences, Peking University, and holds the title of Senior Engineer. He currently serves as Vice President of Changchun Jilin University Zhengyuan Information Technologies Co., Ltd., and as President of the Kunlun Research Institute. He is also a member of the Executive Committee of the Trusted Communications Committee of the China Communications Association and of the Information Confidentiality Technology Committee of the China Computer Association. His current research focuses on post-quantum cryptography, blockchain cryptography, privacy-preserving computing, and AI security. He participated in the research project "Research on Range Proof Algorithms and Ring Signature Algorithms in Blockchain Privacy Protection Mechanisms" of the Cryptography Standardization Technical Committee of the State Cryptography Administration, which was successfully completed in 2022. He also participated in the standard-development project "Ring Signature Mechanism" of the Cryptography Standardization Technical Committee of the State Cryptography Administration, completed in 2025.

In recent years, he has published multiple papers in international journals such as IEEE Transactions on Information Forensics and Security and at international conferences such as IEEE International Conference on Blockchain and Cryptocurrency. As the first inventor, he has applied for more than 60 patents, of which more than 40 have been granted. He has led four teams in two editions of the "Financial Cryptography Cup" National Cryptographic Technology Competition.



Yuqiang Fang
QuantumCTek Co., Ltd.

Talk title: ***Industrial Applications of Single-Photon Detectors in Quantum Information Technology***

Abstract: Single-photon detection technology is currently the most advanced ultra-weak light detection technology, capable of greatly enhancing human observation and perception capabilities and offering broad application prospects. Semiconductor single-photon detectors based on single-photon avalanche diodes (SPADs) have become the mainstream choice in many practical applications due to advantages such as small size, low cost, ease of system integration, and good overall performance. Benefiting from the low transmission loss of near-infrared photons in optical fibers and eye safety, near-infrared InGaAs/InP single-photon detectors have been widely used in quantum communication, highly sensitive sensing, and other fields; while visible-light silicon single-photon detectors were developed earlier and offer better detection performance, playing a key and central role in Lidar, biomedicine, and other fields. With the engineering development of semiconductor single-photon detectors, their performance and integration level will be further improved, opening up more application scenarios in the future. This report introduces QuantumCTek's semiconductor single-photon detector products in the near-infrared and visible-light bands, and describes their industrial applications in quantum information technology fields.

Biography: Fang Yuqiang, male, born in 1992, received his Ph.D. in Quantum Information Physics from the University of Science and Technology of China in 2020. He is a member of Academician Pan Jianwei's team and is mainly engaged in research on core devices for quantum communication and single-photon detectors. He currently works as a senior hardware engineer at QuantumCTek Co., Ltd. and serves as the expert for single-photon detectors. As a key technical member, he has undertaken research projects such as the National Key Research and Development Program "High-Performance Single-Photon Detection Technology" and the Anhui Provincial Major Science and Technology Special Project "Key Technology Research on Communication-Band Single-Photon Detectors." He has published 6 SCI journal papers and been granted more than 10 invention patents, including 1 paper in Nature Photonics, 1 in Physical Review Letters, and 4 in Review of Scientific Instruments.

03 国际环境科学论坛
Environmental Research 2026

Sea Level as Earth's Integrator: Ice Sheets, Earthquakes, Ecosystems, and the Future of Coastal Risk
Benjamin Horton

Environmental and climate consequences of climate intervention
Cao Long

Sustainability Synergies and Trade-offs in Large-Scale Solar Photovoltaics Deployment
Chen Shi

From emissions scenarios to climate projections in a fraction of a second
Chris Smith

Mapping and assessing inequalities, synergies and trade-offs of public and private urban heat adaptation solutions
Giacomo Falchetta

When El Niño Meets the Indian Ocean: Disentangling ENSO and IOD
Giovanni Liguori

Multiyear predictability of East Asian summer heat extremes beyond external forcing
Hu Shuai

Humid Heat Shapes Human Health in a Warming Climate
Huang Tao

From Microphysics to Policy: Constraining Methane and Black Carbon Emissions for Climate Action
Jason Cohen

Climate Resilience: bridging the gap between adaptation and mitigation
Jon Hellin

Understanding and modelling high-end climate risks
Kai Kornhuber

Climate change and wildfire activities across the world and in Southwest France
Laurent Li

The Evolving Air Quality Landscape in China: Interactions with a Changing Climate and the Path to Win-Win Solutions
Liao Hong

Reversibility after reversal? From estimating land-based CDR potentials to the reversibility of ecosystem stress
Lina Teckentrup

Unveiling cascading lag effects of wetland methane emissions in Africa by integrating satellite observations
Liu Mengyao

Complex and Interconnected Climate Risks: Systemic Challenges for Adaptation, Mitigation, and Sustainable Development
Massimiliano Pittore

Differentiable Programming and Hybrid Modelling for Earth System Models
Maximilian Gelbrecht

The potential contribution of biogas and biomethane to the decarbonization of energy systems
Michel Noussan

Recent advances in the understanding of extreme precipitation
Nie Ji

Integrated Assessment of China's Decarbonization Pathways
Ou Yang

Global stilling: recent evolution, future evolution, and prediction skill
Paul Arthur Monerie

Changes in the tropical rainfall seasonal cycle dominated by mesoscale convective systems
Song Fengfei

Short-term ozone exposure and schizophrenia hospitalization risk
Su Hong

Beyond Direct Impacts: Cascading Economic Risks from Climate Extremes
Wang Daoping

Toward Sustainable and Climate-Resilient Cities: High-Resolution Climate Simulation, Impact Assessment, and Adaptation
Yuan Jiacan

Unintended Consequences of Climate Mitigation Actions
Yue Xu

Substantial contributions of natural gas consumption to methane emissions in the Yangtze River Delta cities of China inferred from atmospheric ethane observations
Zhang Yuzhong

Sea Level as Earth's Integrator: Ice Sheets, Earthquakes, Ecosystems, and the Future of Coastal Risk

Benjamin Horton

City University of Hong Kong, China

Sea level is often treated as a single global number, yet it varies across space and time in response to interactions among the cryosphere, ocean-atmosphere system, solid Earth, and biosphere. In this Lecture, I argue that sea level is Earth's integrator, linking disciplines across AOGS from paleoclimate and geodesy to ecology, hazards, and societal risk. Reconstructing past sea level provides the context needed to distinguish natural variability from human-driven change and to understand regional patterns. My research uses geological archives preserved in tidal marshes, mangroves, and coral reefs. Combined with instrumental observations, statistical analyses, and quantitative models, these records reveal how and why sea level has changed. Standardized methods enabled regional databases spanning Africa, Asia, Europe, the Americas, the Pacific, and beyond, culminating in a global atlas that improved understanding of processes such as glacial isostatic adjustment and land subsidence. Focusing on the last 2,000 years, I show how high-resolution reconstructions demonstrate that modern sea-level rise is unprecedented in the Common Era and strongly influenced by anthropogenic climate change. Finally, I explore how sea-level rise affects the resilience of coastal ecosystems, identifying thresholds beyond which tidal marshes and mangroves are more likely to retreat. Sea-level history provides a powerful tool for anticipating future coastal risks and adaptation challenges.

Environmental and climate consequences of climate intervention

Cao Long

Zhejiang University, China

With current rate of global warming, conventional emission reduction method is not likely to limit the amount of global warming to a level we expect. Alternative climate intervention methods including carbo dioxide removal and solar radiation modification are gaining increasing attention. In this talk, I will present some Earth system modeling studies that analyze global and regional climate and environmental consequences of climate intervention methods, such as carbon dioxide removal, stratospheric aerosol injection, and marine cloud brightening. These results will help us to better understand the benefits and risks of different climate intervention methods.

Sustainability Synergies and Trade-offs in Large-Scale Solar Photovoltaics Deployment

Chen Shi

Hong Kong University of Science and Technology, China

Solar photovoltaics (PV) are widely regarded as a cornerstone of global decarbonization. Yet as deployment accelerates from gigawatts to terawatts, a fundamental question emerges: what makes solar energy truly sustainable? While discussions often focus on electricity generation and costs, large-scale PV expansion is increasingly shaped by broader system constraints, including land availability, resource requirements, supply-chain structures, and policy design. This presentation explores how these often-overlooked factors influence sustainability outcomes across the solar value chain. Drawing on recent research in China, we show that technology choices are not determined solely by energy performance. Economic signals, particularly those associated with land resources, can reshape deployment pathways and alter trade-offs between energy yield, land occupation, and material demand. At the same time, the sustainability implications of solar deployment extend beyond project boundaries, with upstream supply chains playing a critical role in determining environmental outcomes. Together, these findings highlight the value of a systems perspective that connects technology, resources, economics, and policy in shaping sustainable solar futures. Such an approach is essential for designing resilient and sustainable pathways toward deep decarbonization.

From emissions scenarios to climate projections in a fraction of a second

Chris Smith

IIASA, Austria

Simple climate models translate emissions scenarios into global temperature projections in a fraction of a second. That speed changes which questions can be asked. Thousands of scenarios can be assessed consistently, uncertainty can be sampled rather than assumed, and results can be updated as new data arrive. Using the FaIR model as a worked example, I will describe what a fast, open emulator makes possible, from attribution of present-day warming to different emissions, countries, and even individual companies, to climate assessment of thousands of scenarios submitted to the IPCC. Calibration of the model on Earth System Model data and constraining outputs to observations will be demonstrated, including how for some applications the simpler models can outperform more complex ones. Using chains of simplified models moving from global, to regional, to climate impacts, we can start to build fully integrated scenarios that “close the loop” back to how climate change affects the drivers of socioeconomic change.

Mapping and assessing inequalities, synergies and trade-offs of public and private urban heat adaptation solutions

Giacomo Falchetta

IIASA, Austria

Extreme heat is one of the deadliest climate hazard, and exposure is rising fastest where urbanisation, population ageing and low adaptive capacity overlap. Cities and households respond through a mix of public adaptation (early warning systems, urban greening) and private adaptation (mainly air conditioning), yet these options are rarely assessed together. This talk brings together global evidence on who gets cooling, who gets shade, and which adaptation portfolio delivers the most protection, at what cost and for whom. First, I present gridded projections showing that residential air conditioning access rises everywhere to 2050 but remains unequal by income, and is least available where heat exposure is highest. Second, I show how street green space, mapped at street level across world cities, reduces heat stress in context-specific ways and could offset only part of the projected rise in heat stress by 2050. Finally, I introduce URBADAPT-HEAT, an open-source framework applied for assessing risk and adaptation to heat at the sub-city scale, applied to a large pool of cities. I derive implications for optimal adaptation portfolio mixes and inequality implications.

When El Niño Meets the Indian Ocean: Disentangling ENSO and IOD

Giovanni Liguori

University of Bologna, Italy

El Niño–Southern Oscillation (ENSO) is the dominant mode of year-to-year climate variability, influencing weather and climate across much of the globe. In 2026, the tropical Pacific is again attracting attention as a rapidly strengthening El Niño develops, with the potential to become an exceptionally strong event. Yet the impacts associated with El Niño cannot be understood from the Pacific alone. ENSO interacts strongly with the Indian Ocean Dipole (IOD), another major mode of tropical climate variability, making their individual contributions difficult to disentangle. In this talk, I will use the developing 2026 El Niño as a starting point to discuss how interactions between the Pacific and Indian Oceans shape tropical climate variability and its global teleconnections. I will present results from targeted climate-model experiments showing that conventional statistical methods can misrepresent the independent influence of ENSO and the IOD, and introduce a new low-dimensional dynamical framework that explicitly separates their independent and interconnected components. Together, these results highlight the importance of viewing tropical climate modes not as isolated phenomena, but as interacting components of a coupled climate system.

Multiyear predictability of East Asian summer heat extremes beyond external forcing

Hu Shuai

Institute of Atmospheric Sciences, Chinese Academy of Sciences, China

Summer heat extremes are intensifying across East Asia, yet whether they are predictable beyond seasonal timescales remains unclear. Here we assess the multiyear predictability of summer heat extremes using a large ensemble of initialised decadal predictions. We show that initialisation provides significant skill for the summer number of hot days beyond the externally forced response, with the clearest added value over eastern China, inland East Asia and Southeast Asia. The ensemble mean nevertheless underestimates the amplitude of the predictable signal, a pronounced signal-to-noise paradox. An RPC adjustment partially corrects this underestimation and improves regional predictions. Predictable component analysis isolates the two most predictable modes of this residual variability, which are rooted in distinct oceanic sources, an extratropical teleconnection driven by subpolar North Atlantic sea surface temperature variability and a tropical pathway sustained by local air–sea coupling over the tropical western Pacific. Together, these results show that decadal predictions can deliver useful early information on regional heat extremes, and that the signal-to-noise discrepancy must be accounted for when such predictions are interpreted and improved.

Humid Heat Shapes Human Health in a Warming Climate

Huang Tao

Nanyang Technological University, Singapore

Climate change is reshaping heat exposure in ways that are not captured by air temperature alone. Multi-phase heatwaves, in which dry and humid heat occur within the same event, reveal a greater cumulative burden of extreme heat than conventional single-metric definitions. Evidence from Hong Kong further shows that wet-bulb temperature is associated with mental health hospitalizations, highlighting the importance of humidity for health risk assessment. Together, these studies demonstrate that humidity, heatwave structure, and population vulnerability need to be considered alongside temperature to better understand climate-related health risks and inform heat-health adaptation.

From Microphysics to Policy: Constraining Methane and Black Carbon Emissions for Climate Action

Jason Cohen

China University of Mining and Technology, China

Satellite observations are the backbone of global climate monitoring, providing essential constraints on greenhouse gases and short-lived climate forcers. However, observations are systematically biased by aerosols, which themselves exert a strong but uncertain influence on the climate system.

I will present recent advances to observationally constrain both methane emissions and black carbon and their climate impacts. I will show how absorbing aerosols produce bidirectional radiance perturbations, leading to overestimation of methane super-emitters by 20-60% and underestimation of background methane levels up to 100 ppb. Both directly impact MRV frameworks, national emission inventories, and the Global Methane Pledge.

I will demonstrate how observationally constrained BC microphysics reveals nonlinear, regionally contrasting radiative forcing that cannot be captured by simplified models. Regionally, BC atmospheric heating can exceed CO_2 and CH_4 combined, with TOA forcing switching sign depending on mixing state.

I will trace the physical chain from microphysics to observational uncertainty to emission estimation bias and policy impacts. How mis-measured emissions undermine MRV, distort national estimates, and lead to mis-attribution. Drawing on IMEO-funded projects in Shanxi and collaborations across Asia and Europe, I will discuss what this means for China's dual-carbon goals and the science-policy interface. Opportunities for win-win reductions of methane and absorbing aerosols will be presented.

Climate Resilience: bridging the gap between adaptation and mitigation

Jon Hellin

International Rice Research Institute, Philippines

In response to the climate crisis, there is much focus on climate adaptation and mitigation. The former includes action to prevent or minimize the dangers of climate change, while the latter focuses on minimizing climate change by reducing emissions of greenhouse gases (GHG). In the agricultural sector, support for adaptation and mitigation often comes from separate funding streams, with a focus on technological innovations that are either 'adaptation' or 'mitigation'. The reality is more nuanced. Firstly, innovations, for example alternative wetting and drying (AWD) in rice cultivation, can address both adaptation and mitigation. Secondly, farmers seldom make a distinction between mitigation and adaptation as they strive to enhance their livelihood security. Thirdly, overly technical programming, driven by external objectives, often discounts the structural socio-economic dynamics that render some categories of farmer especially vulnerable to climate change. A broader climate resilience approach is needed, one that includes technological innovations but is driven by the social, institutional, technological, and cultural change needed to address the structural contributors to farmers' vulnerability, and their differential exposure to climate risk. Climate resilience rests on genuine transdisciplinary partnerships and systems approaches that ensure adaptation and mitigation goals along with more equitable incomes, food security and development.

Understanding and modelling high-end climate risks

Kai Kornhuber

IIASA, Austria

An increase in frequency and magnitude of extreme weather and climate events ranges among the most severe outcomes of anthropogenic climate change, affecting societies in unprecedented ways: through shifts in their seasonality, location, and intensity, and through the emergence of new complex event combinations. Anticipating risks from unprecedented events and their societal impacts requires an improved understanding of the physical processes associated with extreme weather events and is therefore imperative to inform climate mitigation and adaptation efforts. In this talk I will provide an overview of recent advances in the field of high-end climate risks and discuss ways forward.

Climate change and wildfire activities across the world and in Southwest France

Laurent Li

CNRS, France

Wildfires occur when a few fire-conducive factors meet, including dry biomass available as fuel for burning, favourable weather conditions and sources of ignition. Climate change can impact these conditions and thus modify fire regimes. We will first review fire activities across the world, emphasizing on their evolution during recent decades. In many regions, wildfires (big ones, in particular) increase in terms of intensity and area burned while climate warms. But in some regions in South Europe, the correlation between climate and fires decreases in recent decades, due to the application of fire prevention policies. In Southwest France, the fire season was exceptional in 2022 and 2026. For the case of 2022, our attribution study shows clearly that the anthropogenic climate warming plays an important role. We also tend to project that event into future conditions, based on the evolution of its future probability of occurrence.

The Evolving Air Quality Landscape in China: Interactions with a Changing Climate and the Path to Win-Win Solutions

Liao Hong

NUIST, China

Air pollution control and climate change mitigation are closely intertwined. Atmospheric pollutants are the second most important anthropogenic driver of climate change, after long-lived greenhouse gases. The substantial reduction of atmospheric particulate matter resulting from air pollution control measures can lead to an unintended warming, which is counterproductive from the perspective of climate change mitigation. This presentation quantitatively assesses the climate impacts (including changes in mean climate, extreme heat events, and extreme precipitation) since the implementation of China's Clean Air Action Plan, and discusses emission reduction strategies that can achieve co-benefits for both air quality improvement and climate change mitigation. We pay special attention to the climate impacts of spatially optimized sulfur dioxide (SO_2) emission reduction under a carbon-neutral pathway. Owing to the nonlinear aerosol-cloud interaction, the optimized emission reduction strategy limits the regional average increase in ERFaci of more than 0.89 $W \cdot m^{-2}$ to less than 0.13 $W \cdot m^{-2}$ in the short-term future during 2020–2040 and weakens the ERFaci increase by two-thirds in 2060. These findings demonstrate the critical role of targeted emission control in mitigating short-term climate risks while pursuing air quality goals.

Reversibility after reversal? From estimating land-based CDR potentials to the reversibility of ecosystem stress

Lina Teckentrup

Barcelona Supercomputing Center, Spain

Climate change impacts continue to worsen globally, yet current efforts in emission reductions fail to meet Nationally Determined Contributions under the Paris Agreement. This raises two key questions: how can we strengthen climate mitigation, and to what extent are climate change impacts reversible? To address the first question, we used a fully coupled Earth system model with a climate-aware implementation of terrestrial carbon dioxide removal (tCDR) technologies. Our bottom-up approach shows that different tCDR portfolios can reduce atmospheric CO_2 concentrations by 42-55 ppm, with associated reductions in global mean temperature and climate extremes. While these reductions are insufficient to meet the Paris Agreement goals, it highlights the need to invest significantly in both CDR and emissions reductions. To address the second question, we employed idealised CDRMIP experiments to assess the reversibility of ecosystem stress and physiological resilience under rising and declining CO_2 concentrations. We identify Amazonia as a hotspot of hysteretic ecosystem stress responses. While we find no significant changes in physiological resilience during CO_2 ramp-up, resilience is reduced in southern Amazonia during ramp-down compared with equivalent CO_2 levels during ramp-up, pointing to potential limits in the capacity of these ecosystems to recover from stress induced by global change.

Unveiling cascading lag effects of wetland methane emissions in Africa by integrating satellite observations

Liu Mengyao

The Royal Netherlands Meteorological Institute, Netherlands

Atmospheric methane (CH_4) is the second most important greenhouse gas after CO_2, which is about 80 times more effective than CO_2 at trapping heat in the atmosphere. Abating methane emissions is seen as the fastest and cheapest opportunity to slow the global warming due to its shorter lifetime (~9 years). While anthropogenic point sources such as fossil fuel exploitation (oil, gas, coal) are increasingly constrained through targeted satellite missions and aircraft campaigns, emissions from ecosystems (e.g., wetlands and agriculture) remain much less studied and understood. The negative isotopic shift of $\delta\ 13CCH_4$ suggests that the post-2007 increase in methane is very likely driven by microbial (biogenic), particularly from wetlands and agricultural activities in the tropics and subtropics. However, emission quantification in this region is constrained by sparse ground-based observations and difficulties in accurately characterizing seasonal wetland dynamics. Here, we develop a remote sensing–based framework to quantify monthly CH_4 emissions using TROPOMI observations at 0.2° spatial resolution from 2019 to 2022, with a focus on tropical African wetland systems. Our approach integrates high-resolution (20 m) satellite-based wetland inundation mapping that distinguishes open water from inundated vegetation. Our results reveal a strong seasonal amplitude and significant seasonal hysteresis between CH_4 emissions and wetland inundation (i.e., higher CH_4 emissions during the receding phase of inundation) in tropical African wetlands. The cascading chain of "precipitation–wetland inundation–vegetation succession–CH_4 emissions" is demonstrated to drive emission seasonality, characterized by multi-month lags from precipitation to wetland inundation, followed by an additional lag from inundation to peak CH_4 emissions. These findings provide a complete and generalizable mechanistic insight into tropical wetland CH_4 seasonality for process-based modeling and offer new constraints for improving tropical CH_4 flux estimates.

Complex and Interconnected Climate Risks: Systemic Challenges for Adaptation, Mitigation, and Sustainable Development

Massimiliano Pittore

Eurac Research, Italy

Climate change increasingly generates interconnected and cascading risks across economies, societies, ecosystems, and development pathways. Understanding these risks requires moving beyond sector-specific assessments toward a systemic perspective that considers cross-border impacts, compound events, feedback mechanisms, and the interaction between climate and socioeconomic vulnerabilities. This contribution will examine how climate risk is framed and how adaptation and mitigation priorities influence its interpretation, assessment, and governance. It reviews the evolving landscape of climate risk assessment in Europe and internationally, highlighting methodological advances alongside persistent challenges related to uncertainty, temporal and spatial scales, and the integration of diverse forms of knowledge. The contribution will also explore the role of research in supporting effective climate action through sustained engagement with practitioners, policymakers and other stakeholders, where interdisciplinary and co-produced knowledge is essential for translating complex risk assessments into robust, equitable, and sustainable adaptation and mitigation strategies.

Differentiable Programming and Hybrid Modelling for Earth System Models

Maximilian Gelbrecht

Technical University of Munich, Germany

The current generation of comprehensive Earth System models (ESMs) still exhibits significant biases and lacks systematic calibration techniques. Automatic differentiation (AD), which also underlies the ongoing AI revolution, can be a key tool to calibrate ESMs and incorporate data to reduce these biases. By formulating ESMs in a way that is differentiable via AD, we can naturally combine process-based and machine learning models and calibrate them jointly. In this talk, we will explore how differentiable and hybrid models benefit Earth system modelling, exemplified by ongoing work on the atmospheric GCM SpeedyWeather.jl and the land-surface model Terrarium.jl. Combined with GPU acceleration, this approach might pave the way for the next generation of ESMs.

The potential contribution of biogas and biomethane to the decarbonization of energy systems

Michel Noussan

Polytechnic University of Turin, Italy

Biogas and biomethane are emerging as promising alternatives to fossil fuels in the decarbonisation of energy systems, particularly in applications that are difficult to electrify. This talk will provide an overview of the main characteristics of these energy carriers, discussing their advantages and limitations, and reviewing current estimates of their deployment potential across different world regions. Their role will also be assessed in comparison with alternative decarbonisation options for selected hard-to-abate sectors. Particular attention will be given to the key dimensions determining their overall sustainability and competitiveness, including environmental impacts, economic costs, and the availability and supply chains of the biomass resources required for their production.

Recent advances in the understanding of extreme precipitation

Nie Ji

Peking University, China

Extreme precipitation results from interactions among processes spanning a wide range of spatial and temporal scales, and understanding these interactions is essential for improving predictions and projections of high-impact rainfall. This talk will present recent advances in understanding the dynamics and climate response of extreme precipitation. At the weather scale, recent studies highlight how large-scale forcing, mesoscale convective organization, and cloud microphysics jointly regulate the intensity and spatial extent of heavy rainfall. At the climate scale, observations and convection-permitting simulations reveal how these processes respond to warming and provide physical and observational constraints on projections of future precipitation extremes. Together, these advances point toward a more integrated view of extreme precipitation that connects its multiscale physical processes with its response to climate change. The goal of this talk is to synthesize these recent findings and discuss how improved process understanding can help reduce uncertainty in predicting and projecting extreme precipitation in a warming climate.

Integrated Assessment of China's Decarbonization Pathways

Ou Yang

Peking University, China

This talk will introduce recent advances in an integrated assessment model, GCAM-China, and its application to analyzing China's pathway toward carbon peaking and carbon neutrality. It will provide an overview of the model's evolving structure and capabilities and discuss how integrated assessment modeling can be used to evaluate the implications of China's "dual carbon" goals and the broader "1+N" policy framework. The presentation will cover key sectoral dimensions, including power, industry, and buildings, and highlight how different policy measures and structural changes shape energy use and emissions trajectories. It will also outline remaining challenges and future directions for improving model-based policy analysis and supporting more informed climate decision-making.

Global stilling: recent evolution, future evolution, and prediction skill

Paul Arthur Monerie

University of Reading, UK

Terrestrial near-surface (10-m) wind speed decreased over the Northern Hemisphere between 1980 and 2010. In our project (WISTEREA), we revisit this global stilling by comparing station-based observations with multiple atmospheric reanalysis products and assessing their ability to capture past changes in near-surface wind speed. We show that most reanalyses fail to reproduce the observed global stilling, whereas climate models can produce a stilling driven by the externally forced response. Although prediction skill is high for lead times of one to ten years, models tend to underestimate the magnitude of the trend. Finally, terrestrial near-surface wind speed is projected to decrease in the future, though this change remains uncertain, with models showing decreases of varying magnitudes.

Changes in the tropical rainfall seasonal cycle dominated by mesoscale convective systems

Song Fengfei

OUC, China

Global warming is reorganizing atmospheric circulation and hydroclimate, and tropical rainfall is a key manifestation of this response. Yet how these large-scale changes are translated into the tropical rainfall seasonal cycle remains uncertain because organized convection, which produces a large fraction of tropical rainfall and often occurs in mesoscale convective systems, is poorly represented in conventional climate models. Here we use decade-long global simulations with a high-resolution Earth system model coupled to a multiscale modelling framework that explicitly represents deep convection to quantify the role of mesoscale convective systems in future rainfall seasonality. We find that mesoscale convective systems would dominate the future changes in both the amplitude and phase of tropical precipitation seasonal cycle. Under a high-emission scenario, the seasonal cycle of precipitation from mesoscale convective systems is amplified by 38–45% and delayed by 10–15 days, exceeding the corresponding changes in mean tropical precipitation. The delay arises from fewer early season mesoscale convective systems associated with slower seasonal migration of the Hadley cell, whereas amplification is driven mainly by increased rainfall intensity within these systems. These results indicate that organized convection is a major pathway through which warming reshapes tropical rainfall seasonality, affecting the timing and intensity of hydroclimate risks.

Short-term ozone exposure and schizophrenia hospitalization risk

Su Hong

Anhui Medical University, China

A time-stratified case-crossover study examined the effects of ozone (O_3), temperature, and residential greenness on schizophrenia (SCZ) hospitalizations in Anhui Province, China. Based on 160,551 SCZ hospitalizations from 2017 to 2020, the study found that O_3 exposure under high-temperature conditions was significantly associated with increased SCZ hospitalization risk, with a 3.9% increase per 10 μg/m3 rise in O_3 (OR = 1.039, 95% CI: 1.030-1.046). The adverse effect was stronger among patients aged ≥45 years. Higher greenness appeared to mitigate the adverse effects of O_3 exposure, particularly in the North Anhui Plain. These findings suggest that climate warming may amplify O_3-related risks for schizophrenia, while greenspace may provide a protective effect.

Beyond Direct Impacts: Cascading Economic Risks from Climate Extremes

Wang Daoping

King's College London, UK

Climate extremes can generate economic impacts far beyond the locations and sectors directly exposed to physical hazards. This talk examines how such impacts propagate through interconnected economic systems, with a particular focus on supply chains and cross-regional dependencies. Drawing on recent research on extreme heat and other climate-related disruptions, I will show how indirect and cascading effects can substantially reshape both the magnitude and geography of economic risk. The talk will discuss how integrating climate hazards, sectoral vulnerabilities, and economic networks can improve our understanding of systemic climate risk and help identify where adaptation and resilience measures may be most effective. I will conclude by highlighting emerging opportunities to combine established risk-modelling approaches with AI-assisted methods to learn from past disruptions, identify potential propagation pathways, and support more anticipatory assessments of cascading socioeconomic impacts.

Toward Sustainable and Climate-Resilient Cities: High-Resolution Climate Simulation, Impact Assessment, and Adaptation

Yuan Jiacan

Fudan University, China

Climate change and rapid urbanization are jointly intensifying climate hazards and their impacts on human well-being. This presentation introduces an integrated framework that combines high-resolution urban climate simulation, detailed impact assessment, and adaptation evaluation to support sustainable and climate-resilient cities. Using Shanghai and the Yangtze River Delta as examples, I will demonstrate how kilometer-scale modeling quantifies the influences of urban land use, anthropogenic heat emissions, and urban morphology on climate hazards, such as compound heat extremes. These simulations are coupled with epidemiological analyses to assess heterogeneous health impacts. I will further highlight how nature-based solutions, urban design, and climate mitigation pathways can reduce future climate risks while delivering co-benefits for public health and sustainability. This integrated framework provides actionable scientific evidence to support climate adaptation, resilient urban planning, and sustainable city development under a warming climate.

Unintended Consequences of Climate Mitigation Actions

Yue Xu

NUIST, China

Climate mitigation is essential for limiting global warming, yet its unintended environmental consequences remain poorly understood. Here, we highlight potential unintended side effects of two mitigation strategies, large-scale reforestation and stratospheric aerosol injection (SAI), through their interactions with atmospheric chemistry, ecosystems, and the hydrological cycle. Reforestation enhances terrestrial carbon uptake but can increase biogenic volatile organic compound emissions, altering atmospheric chemistry and exacerbating surface ozone pollution in some regions. Similarly, SAI can rapidly offset greenhouse-gas-induced warming by reducing incoming solar radiation, but associated perturbations to atmospheric circulation and the hydrological cycle may increase drought risks in vulnerable regions. Importantly, these adverse effects are highly spatially heterogeneous and may not coincide with the regions receiving the greatest climate benefits. Such uneven distributions of benefits and risks could exacerbate existing environmental and socioeconomic inequalities, raising important questions of climate justice.

Substantial contributions of natural gas consumption to methane emissions in the Yangtze River Delta cities of China inferred from atmospheric ethane observations

Zhang Yuzhong

Westlake University,China

Natural gas consumption in Chinese cities has nearly tripled over the past decade, improving air quality but leaving its climate impacts uncertain due to poorly quantified supply-chain leakage. Here we quantify methane emissions from natural gas consumption in the Yangtze River Delta metropolitan cluster using a decade (2012-2021) of atmospheric ethane (C_2H_6) observations, a tracer unique to fossil fuel sources. By combining observations with model simulations, we find that a leakage rate of 3.5% (2.5-4.3%) is required to reproduce the observed seasonal variability and long-term trends in C_2H_6, far exceeding China's commonly assumed 0.2% inventory value. This estimated leakage rate also implies average methane emission of 0.68 (0.48-0.83) Tg yr-1 over 2012-2021, vastly underestimated or entirely omitted in existing inventories. Our results reveal a substantial underestimation of methane emissions from natural gas consumption and underscore the urgent need to reassess sector-specific methane budgets in rapidly urbanizing regions of China.

04 脑机智能论坛
Brain-Machine Intelligence Forum

Nonlinear Frequency-Domain and Network Analysis of EEG Signals
He Fei

Minimally invasive ECoG device for BCI applications
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精准功能成像与调控
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反问题的智能求解与应用
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读脑与写脑协同驱动脑机智能
梁臻

Nonlinear Frequency-Domain and Network Analysis of EEG Signals

He Fei
Associate Professor at Coventry University

Report Introduction

Neuronal information processing is complex at different levels， from the microscopic pre-and post-synaptic cellular interactions to the macroscopic interactions between large populations of neurons in，for instance，sensory processing and motor response.Various functional and effective connectivity measures have been developed to characterise such functional integration in neural networks， from neurophysiological signals(such as EEG).In current literature，linear modelling，connectivity and causality analysis are still the dominant approaches.Nevertheless， recent studies indicate that linear methods can only capture certain amount of neural activities and functional relationships， and therefore cannot describe neural behaviours in a precise or complete way.In this talk，I will present how nonlinear dynamic modelling/system identification，frequency-domain analysis and network analysis can be integrated to study complex neural interactions； and applied to characterise neurological disorders.

Presenter Biography

Dr Fei He (Senior Member，IEEE) is an Associate Professor in the Centre for Computational Science and Mathematical Modelling，Coventry University，UK.Dr He previously held research positions at Imperial College London，University of Sheffield，and University of Manchester (Manchester Centre for Integrative Systems Biology). He received a PhD and an MSc in control engineering from University of Manchester.Currently，Dr He co-leads the‘Digital Neuroscience’Cross Cutting Theme at Coventry University.His current research interests lie at the interface of control systems engineering，signal processing and neuroscience.He has been awarded several EPSRC grants（as PI and co-I）.He is the Associate Editor of IEEE Transactions on Neural Systems and Rehabilitation Engineering（TNSRE），Frontiers in Neurology，BMC Neuroscience and IET Healthcare Technology Letters.He is also a member of EPSRC Peer Review College and a member of UKRI Talent Peer Review College.

Minimally invasive ECoG device for BCI applications

Chan Kwok-leung

Associate Professor at The University of Hong Kong (HKU)，Founder of Brainsmart Technology

Report Introduction

High-density electrocorticography (ECoG) provides high spatial and temporal resolution for neural decoding, functional mapping, and seizure localization. However, passive electrode arrays require extensive wiring, increasing system complexity and susceptibility to signal contamination. Organic field-effect transistors (OFETs) offer a promising platform for active, flexible ECoG interfaces because of their mechanical compliance, low-temperature fabrication, biocompatibility potential, and compatibility with large-area substrates. Integrated OFET inverters can amplify and buffer weak cortical signals directly at the sensing site, improving signal integrity by reducing the influence of long interconnects and environmental interference. Moreover, OFET-based active-matrix architectures allow electrodes to be selected through shared row and column lines, substantially reducing the number of external connections required for high-channel-count arrays. These advantages could enable lightweight, conformal, and scalable cortical interfaces. Further optimization of transistor gain, contact resistance, operational stability, and circuit uniformity will support the development of reliable OFET-based brain–computer interfaces..

Presenter Biography

Professor Chan Kwok-leung is the Founder of Brainsmart Technology, Associate Professor at The University of Hong Kong (HKU), Managing Director and Co-Director of the InnoHK Advanced Biomedical Instrumentation Centre, and Director of the HKU Central Fabrication Laboratory. His research focuses on micro/nanofabrication, flexible electronic devices, and brain-computer interfaces, while his professional experience spans academic research, research management, and technology transfer. He has received the Outstanding Young Researcher Award and two Research Output Awards from HKU, and was selected for the Royal Society of Chemistry′s Inaugural Physical Chemistry Chemical Physics (PCCP) Emerging Investigators Themed Issue. He currently serves as a non-official member of the HKSAR AI+ and Industry Development Strategy Committee, contributing academic and technical perspectives to the Committee′s work on AI and industry development.

精准功能成像与调控

刘河生

昌平实验室脑科学与类脑研究部首席科学家

报告简介:

人脑的个体差异巨大，现有的功能影像手段尚不能准确、可靠地反映单个患者的脑功能网络，使得功能影像的临床应用受到限制。本讲座将介绍最新的面向个体患者的脑功能成像方法，精确绘制个体水平的脑功能网络。这些先进的神经影像技术有望揭示疾病相关的神经环路，并为多种神经精神疾病提供个性化治疗靶点。在本次报告中，我将重点介绍围绕帕金森病、阿尔茨海默病及其他疾病的环路调控神经调节研究所开展的工作。

报告人简介：

刘河生现任昌平实验室教授，北京大学生物医学前沿创新中心客座教授，中国残疾人康复协会副理事长。曾历任哈佛大学助理教授、副教授、附属麻省总医院 Martinos 中心人脑个体差异实验室主任，美国南卡医科大学杰出讲席教授等职。刘教授长期从事脑功能成像研究，致力于把功能核磁推向临床应用。在 *Nature*，*Nature Methods*，*Nature Neuroscience*，*Neuron* 等神经科学期刊发表论文 160 多篇。

反问题的智能求解与应用

杨易

浙江大学求是讲席教授、人工智能研究所所长

报告简介:

反问题广泛存在于科学探测、工程技术及医学成像等领域，其求解通常面临观测数据不充分、噪声干扰以及模型不确定性等挑战。近年来，人工智能技术的快速发展为复杂反问题的高效求解提供了新的思路与方法。本报告围绕反问题的智能求解方法及其应用展开，介绍数据驱动方法、物理信息神经网络以及模型与数据融合等主要技术路径，探讨人工智能与传统数学方法相结合的研究进展。在此基础上，结合三维重建、物理参数反演等典型应用场景，讨论智能求解方法的应用潜力与发展趋势。最后，围绕智能反问题求解在泛化能力、稳定性、可靠性等方面面临的挑战，探讨未来值得关注的研究方向。

报告人简介：

杨易，IEEE Fellow、IAPR Fellow，浙江大学求是讲席教授、人工智能研究所所长，微软-教育部视觉感知重点实验室主任。长期从事人工智能基础理论及跨学科应用研究，主持科技部 2030“新一代人工智能”重大项目、国家自然科学基金重点专项等。获浙江省自然科学一等奖、ACM MM 最佳论文奖、吴文俊人工智能科学技术奖自然科学一等奖等。

多模态情感脑机接口

郑伟龙

上海交通大学副教授

报告简介:

情感是人类认知与智能行为的重要组成部分，构建能够感知、理解和解码人类情感状态的脑机接口，是脑科学、人工智能与人机交互交叉领域的重要前沿方向。报告将围绕多模态情感脑机接口展开，介绍自然场景下脑电、眼动等多模态情感信息的采集与表征方法，探讨情感相关脑神经活动的时空频谱特征及其跨模态关联机制。在此基础上，重点介绍多模态脑电基础模型的构建方法，通过大规模多模态神经数据预训练与统一表征学习，提升情感脑机接口对复杂情感状态的理解、解码与跨场景泛化能力。进一步结合大模型与多模态智能技术，探索从脑信号感知到情感语义理解的新型脑机交互范式，为情感计算、心理健康辅助评估以及自然人机协同等应用提供新的技术路径。

报告人简介：

郑伟龙，上海交通大学计算机学院副教授，博士生导师。入选国家级高层次海外青年人才和上海市海外高层次青年人才，“脑科学与类脑研究”国家科技重大专项青年首席科学家。麻省理工学院和哈佛大学医学院麻省总医院博士后。长期从事脑认知与智能、情感计算、脑机交互、类脑计算和人工智能等研究。主持及参与多项国家级和省部级研究项目，发表研究论文 150 余篇。荣获 IEEE Transactions on Autonomous Mental Development 最佳论文奖、IEEE Transactions on Affective Computing 最佳论文奖、ACM Multimedia Top Paper 奖和 ARC Prize 最佳论文奖、亚太神经网络学会青年研究者奖、中国人工智能学会优秀博士学位论文奖和吴文俊人工智能自然科学一等奖，入选首届中国脑机智能科学新星、上海市浦江人才、小米青年学者和全球前 2%科学家年度影响力榜单 (2023-2025)。目前担任 IEEE Transactions on Affective Computing 编委。

人脑意识与知觉的脑网络机制

吕典

浙江大学脑与脑机融合前沿科学中心，研究员

报告简介:

意识与知觉依赖大尺度脑网络的动态整合与重组，但其因果机制尚不明确。过去十年，申请人结合深部脑刺激、多模态神经成像与计算建模，围绕"网络重组—知觉转换—自我意识"开展系统研究：首次绘制人类丘脑刺激诱发的全皮层效应图谱，揭示深部节点对全脑网络重组的调控作用；验证自发脑网络动态对视知觉状态转换的影响；识别前楔叶相关网络对具身自我意识的因果作用。成果发表于*Nat.Neurosci.*、*Neuron*、*Nat.Commun.*等期刊，获斯坦福大学 Sammy Kuo Awards 一等奖及多项国际学术荣誉。申请人现任职浙江大学，拟聚焦丘脑-皮层环路动力学，揭示脑网络组织与意识加工机制，为神经调控新方法提供理论基础。

报告人简介：

吕典，浙江大学脑与脑机融合前沿科学中心研究员。2021 年获剑桥大学临床神经科学博士学位，随后在斯坦福大学医学院开展博士后研究。2025 年 9 月加入浙江大学并建立研究团队。其研究聚焦于人类意识与大尺度脑网络的神经机制，综合运用颅内脑电、颅内电刺激与神经影像等多模态人类数据，考察大脑自发性动态过程、丘脑-皮层环路以及扣带回等关键整合节点在人类主观感受形成过程中起到的作用。

群体神经几何：连接自然智能和人工智能的桥梁

张洳源

北京大学心理与认知科学学院和麦戈文脑科学研究院，研究员

报告简介:

人脑如何通过神经群体活动表征信息、形成知识并实现灵活推理？人工智能又能从人脑认知机制中获得哪些启发？本报告以神经群体表征几何 (neural population geometry) 为核心框架，探讨神经科学与人工智能之间的双向启发。首先，介绍神经群体编码的几何理论，阐释神经元间响应相关性如何影响信息编码，以及视觉知觉学习和注意如何通过改变群体表征几何提升信息处理效率。随后，聚焦抽象视觉推理，介绍受神经预测误差与概念学习机制启发的人工智能模型，展示模型如何从监督学习逐步迈向少标签半监督学习和无标签自监督学习，实现抽象规则的提取、概念的组合与新情境下的泛化。最后，报告将讨论如何结合表征几何分析与神经科学启发的计算模型，揭示知识形成与抽象推理的计算机制，并为理解自然智能和发展更具泛化能力的人工智能提供新的研究思路。

报告人简介：

张洳源博士现任北京大学心理与认知科学学院、IDG 麦戈文脑科学研究院双聘课题组长，长期致力于脑科学与类脑智能交叉研究。以第一或通讯作者在 *Nature Human Behaviour*、*Science Advances*、*Nature Communications*，*PNAS* 等期刊发表论文，相关成果发表于 TPAMI、ICML、IJCAI 等顶级期刊和会议。现任多本期刊编委及 ICML、NeurIPS、ICLR 等顶级会议领域主席。主持国家自然科学青年基金 B 类项目和脑科学与类脑研究重大项目子课题，曾获上海市浦江人才计划、海外高层次人才等荣誉，并获世界人工智能大会青年优秀论文提名。

从学习动力学到类脑架构：任务学习中网络模块化的涌现

顾实

浙江大学长聘副教授

报告简介:

本报告从网络神经科学视角出发，结合两项研究，探讨人工神经网络在学习中形成的类脑组织原则。研究发现，在持续熟悉性判断任务中，采用赫布学习的前馈网络随学习逐步重组模块结构，模块灵活性反映学习动态，模块度能够预测任务表现。进一步研究表明，多任务学习可增强循环神经网络的模块化程度，且任务负荷超过表征容量时效应更强；连接增量学习可在保持性能的同时强化模块化。形成的模块支持相关任务共享表征，网络结构也比仅考虑空间布线约束的模型更接近实测脑网络。这些发现支持了"人工网络神经科学"框架，揭示模块化能够随学习自发涌现并适应任务需求，为构建可解释、适应性强的神经网络提供设计依据。

报告人简介：

顾实，浙江大学计算机科学与技术学院、脑机智能全国重点实验室长聘副教授，博士生导师，国家青年特聘专家，入选福布斯中国"30 岁以下 30 人"榜单。美国宾夕法尼亚大学博士，清华大学学士。研究方向为类脑智能，论文发表于 *Nature Machine Intelligence*、*Nature Communications*，*Science Advances*，*PNAS*，NeurIPS，ICML，ICLR 等国际期刊或会议上，担任 ICML、NeurIPS、ICLR 等人工智能会议的领域主席和 TMLR 等期刊的执行编辑。

持续学习视角下的生物智能与人工智能协同演化

王立元

清华大学心理与认知科学系 助理教授、特别研究员
清华-IDG/麦戈文脑科学研究院 研究员

报告简介:

持续学习是连接生物智能与人工智能的重要研究方向，旨在使智能系统在动态开放环境中持续获取、整合、更新和利用知识。本报告从人工神经网络的灾难性遗忘问题出发，介绍脑启发的持续学习理论、方法与应用：一是借鉴生物学习记忆系统的主动保护、主动遗忘和平行模块机制，构建脑启发的持续学习计算模型；二是面向具身智能的空间能力，探索脑启发的结构化空间记忆，推动智能体从即时反应走向长时程、强泛化的空间认知；三是面向多模态生理信号监测问题，构建持续学习驱动的生成式基础模型，实现多模态生理信号的统一建模与灵活生成，支持生命体征与异常状态的实时全面监测。

报告人简介：

王立元，清华大学心理与认知科学系助理教授、特别研究员。研究方向为脑启发的持续学习理论与方法，并推动其在科学智能、智慧医疗、具身智能等场景中的应用，研究成果以第一/通讯作者多次发表在 *Nature Machine Intelligence*、TPAMI、NeurIPS、ICML、ICLR 等人工智能相关领域的顶级期刊和会议。主持国自然青年科学基金项目 (B 类)、北京市科技新星项目，曾获中国人工智能学会首届清源学者、世界人工智能大会云帆奖及青年优秀论文奖。

Evoplasticity：神经回路约束下的异质性突触可塑性规则发现

吴冀彬

香港理工大学 助理教授

报告简介:

突触可塑性是学习与记忆的核心机制，但局部可塑性规则如何在行为过程中实现跨神经回路的信用分配，仍不清楚。目前实验方法难以同时观察与行为相关的多个突触，而计算方法则需要在搜索广度、可解释性、生物真实性与行为相关性之间权衡。我们提出 Evoplasticity，一种受达尔文进化思想启发的框架，用于在生物可信的小鼠初级视觉皮层模型中，发现支持行为任务的特异性突触可塑性规则。候选规则由局部突触信号的门控多项式表示，在多个模型实例中并行演化迭代，并根据行为表现、与实测神经活动的相似性及规则简洁性进行评分。在基准测试中，Evoplasticity 成功恢复了经典的 Oja 规则、脉冲时序依赖可塑性（STDP）及奖励调制 STDP。在视觉变化检测与持续决策任务中，该框架发现了形式简洁的可塑性规则，既能达到相应的动物行为表现，又能重现关键神经活动特征，并可泛化至不同网络规模和任务难度，在扰动下仍保持鲁棒。Evoplasticity 为神经科学提供了可通过实验检验的突触可塑性假说，也为数据高效的人工智能提供了新的学习原理。

报告人简介：

吴冀彬，香港理工大学数据科学与人工智能学系助理教授，本科及博士毕业于新加坡国立大学。主要研究类脑计算与语音信号处理，在 *Nature Communications*、IEEE TPAMI、NeurIPS 等国际期刊与会议上发表论文 90 余篇，目前担任 IEEE TNNLS、IEEE TCDS、IEEE CIL 等国际期刊编委。曾获得 2025 年机器智能与自然计算国际会议最佳论文奖、2024 年 IEEE 人工智能大会最佳论文奖、2023 年 Intel 神经形态语音降噪挑战赛冠军以及 2018 年世界大学生类脑计算大赛决赛一等奖等多项国际奖项。

脑机解码与大模型类脑对齐机制

杜长德

中国科学院自动化研究所 副研究员

报告简介:

人工智能与脑科学的深度交叉正引领脑机融合智能的新浪潮。本报告围绕"AI 赋能脑解码"与"脑启发 AI 对齐"双主线展开。在脑机解码 (AI for Brain) 方面，针对传统模型存在语义鸿沟与泛化困难的瓶颈，提出基于"脑-图-文"多模态共享隐空间的新型神经解码框架，实现了零样本视觉语义解码的突破。在大模型类脑对齐 (Brain for AI) 方面，针对 AI 黑箱可解释性难题，引入大规模机器行为学解析范式，定量揭示大模型在具象物体与抽象情感上自发涌现的低维概念流形，并证实其与人脑皮层神经活动的高度同构性。最后还将探讨如何以类脑概念表征为桥梁，构建高泛化脑信号解码基座模型，为双向脑机智能提供支撑。

报告人简介：

杜长德，中国科学院自动化研究所副研究员，国家级青年人才，小米青年学者。长期深耕 NeuroAI 与脑机智能前沿，聚焦神经编解码与大模型类脑对齐机制。在 *Nature Machine Intelligence*、TPAMI、ICLR、ICML、NeurIPS 等发表论文 50 余篇。主持国自然基金委青 B（原国家优青）、面上等项目，作为项目骨干参与脑计划国家科技重大专项。曾获中科院院长奖、ICME 最佳论文（亚军）等，成果被 *MIT Technology Review* 头条报道。担任 *The Innovation Informatics* 青年编委及 *Nature*、*Science* 等顶刊审稿人。

人类语言的神经编码、计算模型与脑机接口

李远宁

上海科技大学 助理教授

报告简介:

语言在人类交流、认知和社会互动中发挥着至关重要的作用。理解人类语言的神经基础，不仅有助于推动认知和计算神经科学的发展，也对交流障碍的神经康复具有重要意义。本报告将介绍近期利用人类颅内脑电记录和人工智能模型，理解与重建语言感知及产生过程的计算研究。我们揭示了声调语言和非声调语言在言语感知与产生过程中的关键神经编码机制，并发现生物语言网络与数据驱动的大语言模型在表征上具有一致性。在此基础上，我们进一步展示了如何利用专门设计的 AI 模型构建语言脑机接口，直接根据言语感知与产生过程中的颅内脑电记录合成语音和文字，帮助言语功能障碍患者重建交流功能。

报告人简介：

李远宁，上海科技大学生医工学院助理教授，国家高层次青年人才计划入选者，“脑科学与类脑研究”国家科技重大专项青年首席科学家，卡内基梅隆大学神经计算与机器学习博士，加州大学旧金山分校神经外科博士后。长期从事计算认知神经科学与侵入式脑机接口研究，第一及通讯作者论文发表在 *Nat Neurosci*，*Nat Commun*，*Sci Adv* 等期刊。主持国家科技重大专项等多项科技部、国自然项目，曾获美国 NIH“神经科学杰出学者奖”，2023“脑科学与类脑智能科创新青年 30 人”。

读脑与写脑协同驱动脑机智能

梁臻

深圳大学 研究生院副院长、教授、博导

报告简介:

脑机接口正从单向的脑信息解码向读脑与写脑协同的闭环脑机智能发展。随着人工智能与脑科学的深度融合，脑机接口在脑信息感知、认知状态理解、智能交互及人机协同等方面展现出新的发展潜力，为探索大脑信息处理机制和构建新型脑机智能系统提供了新的研究思路与技术路径。本报告将围绕脑机智能的发展趋势，介绍脑信号智能解码、多模态脑信息分析、脑状态智能识别及闭环脑机接口等方面的研究进展，重点探讨人工智能技术在脑信息表征、跨模态融合及脑机交互中的作用，分析当前脑机智能面临的关键科学问题与技术挑战，展望其在神经疾病诊疗、脑功能增强和人机协同智能等领域的应用前景与未来发展方向。

报告人简介：

梁臻，国家高层次青年人才，深圳大学研究生院副院长、生物医学工程学院教授，博导。曾任职美国脑机接口公司 NeuroSky 和日本京都大学。专注于脑机接口与神经调控研究，以第一或通讯作者累计发表高水平论文 70 余篇，包括 *Cell Reports Medicine*、*Advanced Science* 等。担任 IEEE TAFFC、IEEE TNSRE、*Neural Networks*、*Cyborg and Bionic Systems* 的编委。主持国自然青 B/面上/青年项目等。荣获中国图像图形学学会石青云女科学家奖、广东省青年拔尖人才、深圳市海外高层次人才、IEEE SMC Winner 奖、深圳人工智能卓越服务奖等。

05 具身智能机器人与应用论坛
Embodied Intelligence Robotics and Applications Forum

True Digital twins of Humans and Industrial Resources for Sustainable Production
Björn Johan Ingemar Johansson

Sensing Systems That Know What They Don't Know — An Honest Boundary for Adaptive Health Monitoring in the AI Era
Frederik Banis

Robotics and AI for Intelligent Interactions. State of the Art, Trends and Future Applications
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曾文军

GPT-6 Astra: 3D, Embodied AI, and Beyond
朱文韬

True Digital twins of Humans and Industrial Resources for Sustainable Production

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Abstract

Industry 5.0 calls for production systems that combine advanced automation with human expertise, well-being, and agency. This paper presents an integration-oriented blueprint for intuitive human–cobot interaction, demonstrated through the digital twins of the SII-Lab. Camera-based 3D pose estimation translates a compact vocabulary of static postures and hold-time confirmations into discrete command identifiers. These commands are routed through an industrial integration layer and mapped to cobot and connected-equipment functions, including task initiation, parameter adjustment, coordinated execution, and application-level safe-stop logic. The SII-Lab digital twins synchronize physical assets, human actions, and system states, providing a shared environment for configuring interactions, observing behaviour, and evaluating production scenarios before and during operation. Controlled trials demonstrate how gesture recognition, industrial communication, asset-specific execution logic, and synchronized digital-twin data can be combined into a practical workflow for human-centric manufacturing. The resulting approach reduces interaction complexity, improves operator situational awareness, and enables operators to supervise and influence automated work more directly. The talk will elaborate on a transferable architecture for using digital twins to support safe, adaptive, and empowering collaboration between human operators and cobots in sustainable production systems.

Presenter Biography

Björn Johansson research focuses on the design and development of sustainable, resilient, and human-centred production systems. A central theme in his work is the use of digital twins and simulation to connect people, industrial resources, and production processes across the system life cycle. By combining virtual representations with real-world data, these approaches support better planning, decision-making, learning, and continuous improvement in complex manufacturing environments. Johansson has a particular interest in true digital twins of both human operators and industrial resources. His work explores how digital technologies can strengthen — not replace — human expertise by making information more accessible, improving situational awareness, and enabling operators to understand and influence production outcomes. This includes developing methods and tools that support safe, efficient, and inclusive work, while accounting for human capabilities, variability, and well-being. Through interdisciplinary research and close collaboration with industry, Johansson contributes to the transition toward sustainable production by integrating technical performance with environmental and social perspectives. His work aims to empower operators, engineers, and decision-makers to jointly shape adaptable production systems that use resources responsibly, respond effectively to change, and create long-term value for industry and society.

Sensing Systems That Know What They Don't Know — An Honest Boundary for Adaptive Health Monitoring in the AI Era

Frederik Banis
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Abstract

Contactless health monitoring promises unobtrusive care at home and in hospital wards, but trustworthy sensing requires more than accurate predictions. This talk asks how sensing systems can recognise the limits of their own knowledge. Drawing on simulation studies of radar-based respiratory monitoring, I examine Bayesian uncertainty estimation and information-guided measurement selection. The results reveal a clear boundary: adaptive sampling improves reconstruction relative to random schedules, but does not consistently outperform a competent fixed protocol. Uncertainty estimates that appear satisfactory under modelled conditions can become overconfident when breathing patterns change or motion disrupts the signal. Waveform calibration, acquisition quality, and alarm reliability therefore require separate evaluation. These findings motivate calibrated humility: evaluating where systems fail as carefully as where they succeed. I connect this measure-infer-decide-act principle to a wider research programme in human-supervised scientific experimentation. For AI-enabled healthcare and autonomous science, the goal is not only greater capability, but trustworthy decisions grounded in explicit evidence and limits.

Presenter Biography

Dr. Frederik Banis is a researcher at the Hangzhou Gongshu District Gongda Future Institute of Technology, China, working on physically grounded machine learning for adaptive biomedical sensing and autonomous experimental systems. From 2020 to 2025, he was a postdoctoral researcher and scientific officer at ETH Zurich, where he worked on energy system optimisation, nonlinear system identification, and automation. He received his PhD in system optimisation and control from the Technical University of Denmark in 2020. His research connects probabilistic inference, model predictive control, and sequential decision-making, with an emphasis on uncertainty-aware sensing and experimental design.

Robotics and AI for Intelligent Interactions. State of the Art, Trends and Future Applications

Ryad. CHELLALI
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Abstract

Robotics and AI are tightly coupled since the origins of both. AI bringing decision and perception autonomy in robots and robotics offering a body to AI systems allowing interacting with real world (Shaky in Stanford). Autonomous driving and advanced are the most visible of the AI-robotics cross-fertilization. The more is to come, as AI is moving so fast and answering to many fundamental questions. That said, AI is reaching these days a plateau: many fundamental issues are preventing to express its full potential. Among these issues I will consider only two: the causality and transfer learning (or generalization capabilities). In the case of robots endowed with embodied intelligence, we can add another aspect: knowing human as an organic agent (in the context of human robot interactions). In my speech I'll give the timeline of robotics and AI and introduce the three issues mentioned above with some ideas about developing the multi-disciplinary research towards an effective AI in industrial and service to people applications.

Presenter Biography

DrSc. H.D.R. — Qualification Diploma as Professor of Robotics and Computer Sciences
University of Nantes, France | July 2005
Keywords: Human–Robot Interaction and Teleoperation; Autonomous Robotics; Computer Vision; Virtual and Augmented Reality.

Ph.D. in Robotics and Automatic Control
University of Paris Pierre et Marie Curie (Paris VI), France | September 1993
Keywords: Computer Vision; Perception; Mobile Robotics.

D.E.A. (equivalent to a Master of Science degree)
University of Paris Pierre et Marie Curie (Paris VI), France | September 1988
Keywords: Electronics; Embedded Sensors; Teleoperation.

Engineering Diploma in Electronics and Telecommunications
École Polytechnique d'Alger, Algeria | January 1987
Keywords: Hyperfrequencies; Telecommunications and Networking; Embedded Electronics.

工业大模型+智能体+数字族谱：驱动未来工业世界

任磊
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报告简介：

本报告将探讨“人工智能+新型工业化”热点技术方向。总结工业互联网与人工智能 2.0 融合创新的热点技术;阐述大模型和智能体驱动的人工智能 3.0 时代背景下，工业大模型的全新定义与内涵、体系架构、关键技术、典型应用；同时介绍工业智能体的模型、系统架构与典型应用；并且，提出支撑工业大模型和具身智能世界模型的“数字族谱”理论技术体系；最后将展望未来发展方向。

报告人简介：

北京航空航天大学二级教授，国家杰青，“十四五”国家重点研发计划工业软件重点专项首席科学家，“十五五”国家重点研发计划专家组成员，复杂产品智能制造全国重点实验室专委会主任，复杂产品先进制造系统教育部工程研究中心主任。主持国家重大科技专项、国家重点研发计划、自然科学基金重大研究计划等国家级和省部级项目 30 余项。在国内外学术界提出了首个工业大模型和工业智能体理论技术体系并制定了首个国家标准体系。在 IEEE 汇刊等国际顶级刊物发表论文 100 余篇，入选斯坦福全球前 2%顶尖科学家终身影响力榜单。主持或参与制订国际/国家标准 30 余项。获专利及软著 100 余项。近 5 年获省部级一等奖 6 项，包括北京市科技进步一等奖、中国电子学会科技进步一等奖、中国自动化学会科技进步一等奖、机械工业科技进步一等奖、中国仿真学会科学技术一等奖等。担任 IEEE、CCF、CAAI、CAA 等 10 余个国内外专委会委员，IEEE 智能制造国际标准专家委员会委员，中国仿真学会常务理事，中国工业互联网产业联盟工业智能组副主席，IEEE TNNLS、IEEE/ASME TMECH、中国科学等国内外期刊编委。

Data-Driven Approaches to Active Noise Control Systems

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Abstract

Active noise control (ANC) systems often operate in environments containing both deterministic and broadband noise, where traditional methods are limited by the need for prior acoustic measurements. This talk presents data-driven approaches using deep learning to predict acoustic pressure and capture spatial patterns in sound fields. It further explores the potential of intelligent ANC systems to address nonlinearities in electro-acoustic environments and improve broadband noise suppression. A direct control design framework based on near-field acoustic holography is introduced, enabling controller development without requiring detailed system models. The presentation concludes with practical insights into implementing effective ANC strategies for reducing noise transmission through encapsulated structures.

Presenter Biography

Hamid Reza Karimi is a Professor of Applied Mechanics at Politecnico di Milano, Italy, focusing his research on intelligent control systems and mechatronics. Prof. Karimi is an ordinary *Member of Academia Europaea* (MAE), President-Elect and Distinguished Fellow of the *International Institute of Acoustics and Vibration* (IIAV), Member of *European Academy of Sciences and Arts* (EASA), Member of The *European Academy of Sciences* (EurASc), and Member of Agder Academy of Science and Letters in Norway. Prof. Karimi is the recipient of THE ISCM PRIZE, the BINDT CM Innovation Award, the Web of Science Highly Cited Researcher in Engineering, JSPS Research Award, and Alexander-von-Humboldt-Stiftung research Award, for instance. He has served as vice-president for International Prize "Lombardia è ricerca". Additionally, Prof Karimi is the President of the 2026 China-Europe Scientists Forum and he is an Honorary Visiting Professor in the School of Computing & Engineering at the University of Huddersfield, UK and the Global Joint Professor of Kyungpook National University (KNU), South Korea.

Multimodal AI for Precision Healthcare: From Biomedical Data to Clinical Decision Support

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Abstract

The rapid growth of biomedical data, including medical images, physiological signals, genomic data, clinical records, and real-time sensor data, offers new opportunities for accurate disease diagnosis. However, these data are often complex, diverse, and voluminous. Advanced multimodal artificial intelligence (AI) techniques can help combine and analyze these different types of data to support better clinical decisions. This presentation introduces a complete research pipeline, from biomedical data collection to the practical deployment of AI-based diagnostic systems.

The presentation begins with biomedical data collection, focusing on data quality, standard procedures, and ethical issues. It then discusses data preprocessing techniques, such as noise removal, normalization, image segmentation, feature extraction, and handling missing data. The main focus is on developing multimodal AI models that combine medical images, signals, text, and labora tory results. Different AI methods, including CNNs, Transformers, Mamba, JEPA, and medical world models, will be introduced. The presentation will also cover model training, validation, interpretability, and methods for improving model performance and reliability. Finally, the talk explores the challenges of using AI in real healthcare settings. These include system integration, scalability, user-friendly interfaces, and regulatory requirements. By combining modern AI techniques with biomedical knowledge, this presentation aims to provide practical guidance for developing accurate, reliable, and effective AI-based diagnostic systems to improve healthcare.

Presenter Biography

Dr. Mohammad Monir Uddin is a Professor in the Department of Mathematics and Physics at North South University (NSU), Bangladesh. He received his Ph.D. from the Max Planck Institute for Dynamics of Complex Technical Systems in Germany. He also holds an M.S. in Applied Mathematics from Stockholm University, Sweden, and B.Sc. and M.Sc. degrees in Mathematics from the University of Chittagong, Bangladesh.

His research interests include bioinformatics, deep learning, data science, and model order reduction. He has published numerous research articles in reputable international journals and presented his work at conferences around the world. He has also contributed to book chapters and authored books and research monographs. He has successfully completed several national and international research projects and continues to lead research initiatives in AI-driven healthcare. His current research focuses on multimodal AI for cancer detection, automated contouring for radiotherapy, AI-assisted treatment planning, and personalized drug design. His work aims to bridge mathematical and computational innovation with practical challenges in healthcare.

Prof. Monir Uddin also holds several academic and research leadership roles. He is the President of the Bangladesh Society for Modeling and Simulation (BSMS), Director of the North South University Technology Transfer Office, and Team Leader of the Big-Matrix R&D Lab. Through these roles, he promotes innovation, strengthens collaboration between academia and industry, and facilitates the translation of research into practical applications for societal benefit.

世界模型:面向未来的具身智能底座

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报告简介：

报告围绕空间智能、世界模型、相关工作、未来展望四部分展开。

1. 空间智能：人类如何获得智能，空间智能定义，空间智能三大关键问题
2. 世界模型：概念，世界模型在 AI 时代的角色及作用，世界模型影响，技术发展历程，关键进展
3. 相关工作展示

世界模型未来展望

报告人简介：

曾文军，清华大学学士、美国圣母大学硕士、普林斯顿大学博士，IEEE Fellow, 国家级人才，加拿大工程院外籍院士，宁波东方理工大学讲席教授、创校科研副校长，宁波数字孪生（东方理工）研究院创始执行院长。原微软亚洲研究院首席研究员和高级领导团队（SLT）成员，带领团队为微软认知服务、微软云平台 Azure 的媒体分析服务、Office、Dynamics 和 Windows Machine Learning 平台提供了大量视频分析技术。2003 年至 2016 年任职于密苏里大学计算机科学系，先后任副教授和正教授。曾先后在美国松下信息技术实验室，贝尔实验室， 夏普实验室，PacketVideo（世界第一家无线视频独角兽初创公司）等公司工作。他对国际标准（ISO MPEG （国际视频编码标准）、 JPEG2000（国际图像编码标准） 和 Open Mobile Alliance （国际开放移动联盟））发展做出重大贡献。他是《国际计算机视觉期刊》的编委、*IEEE Journal of Selected Topics in Signal Processing* 的资深编委，担任过多个 IEEE 期刊的副总编、副主编或指导委员会成员，并担任多个 IEEE 国际会议 (如 ICME 2018、ICIP 2017) 的大会主席或技术程序委员会主席。

GPT-6 Astra: 3D, Embodied AI, and Beyond

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Abstract

This talk discusses what GPT-6 Astra means for 3D and embodied AI. The first part looks at Astra in 3D, where it works as an inverse graphics agent: write code, render, inspect, and iterate. The second part turns to embodied AI: how such a model can orchestrate robot skills, control a robot directly, and help train policies, drawing on our own experiments with agentic robotics across several robot platforms, and what may come next as foundation models start to learn from interaction. The third part is my own reading of why this works, using the perception-action loop as a starting point, and where the remaining bottlenecks sit on the two arrows of the loop: how the model perceives the physical world, and how it represents and emits actions.

Presenter Biography

朱文韬，宁波东方理工大学助理教授、博士生导师。研究方向为计算机视觉、具身智能、数字孪生、认知计算等。此前于北京大学获得博士学位（2025）及计算机科学、经济学双学士学位（2020）。

一作论文涵盖 IEEE TPAMI、CVPR、ICCV、ECCV、NeurIPS、ICLR、ICML 等顶会顶刊，并长期担任这些会议及期刊的审稿人。曾在高通人工智能研究院（Qualcomm AI Research）、上海人工智能实验室、商汤科技等机构担任实习研究员及研究顾问，并于香港中文大学多媒体实验室（MMLab）和斯坦福大学等高校访问。任 NeurIPS 2025 领域主席（Area Chair）。在 CVPR 2025 组织首届“人形智能体（Humanoid Agents）”研讨会。中国图像图形学会三维视觉专委会委员。曾获北京大学“挑战杯”五四青年科学奖特等奖、北京大学国家奖学金、AAAI 奖学金、苹果 WWDC 奖学金、NeurIPS 优秀审稿人等荣誉与奖励。

研究领域：主要研究方向包括计算机视觉、具身智能与认知科学的交叉领域，聚焦于构建能够感知、理解并与人类自然交互的人工智能。研究内容涵盖人类行为的感知与建模（如动作捕捉、三维重建与重定向）、理解与推理（如视频理解与行为识别），以及具身智能体在物理和社会环境中的人机交互，结合认知科学机制提升智能体的社会认知与推理能力等。相关研究成果已被华为、高通、苹果等企业在实际系统中应用。

06 深海资源环境论坛
Deep Sea Resources and Environment Forum

先知后行：从海洋地球科学视角看可持续蓝色经济
穆罕默德·哈菲兹·本·杰奥弗里

利用体长频率分析模型对巴基斯坦水域黄鳍金枪鱼资源量进行评估：生长、死亡率及开发状况
艾达·俾路支·阿卜杜勒·瓦希德

看不见的深海：通过微生物基因组学探索海洋资源与环境变化
卡罗莱娜·萨尔瓦多

先知后行：从海洋地球科学视角看可持续蓝色经济

穆罕默德·哈菲兹·本·杰奥弗里

登嘉楼大学

海洋资源需求持续增长，引出一个根本性问题：我们是否已充分认识海洋系统，从而负责任地开展干预？本报告以海砂开采与深海采矿为例，探讨海洋地球科学如何为资源开采与开发相关决策提供支撑。报告分析人类扰动会如何影响沉积物运移路径、海床稳定性及生态系统，以及这类环境压力如何与气候变化叠加作用。本次论述着重强调：在缺少完备环境基线、对累积影响与生态恢复能力认知不足的情况下采取行动，将会产生诸多后果。知识与技术是评估上述风险的基础，但负责任的决策同时要求我们正视不确定性与环境承载力。想要实现可持续的海洋未来，必须依靠科学认知来划定开发的地点、时机与约束条件。

利用体长频率分析模型对巴基斯坦水域黄鳍金枪鱼资源量进行评估：生长、死亡率及开发状况

艾达·俾路支·阿卜杜勒·瓦希德

自然资源部第一海洋研究所

尽管经济价值突出，该渔业长期缺乏监管。保障其可持续性亟需开展资源量科学评估。本研究基于 4476 尾样本（体长 500–1500 毫米），采用 TropFishR 与 LBB 模型开展体长型资源评估。Von Bertalanffy 生长参数显示渐近体长 L_{∞}=156，生长系数 K=0.41 yr^{-1}，生长性能Φ'=3.99，种群属于中等生长水平。但捕捞开发率 E=0.64，远超可持续阈值 E_{max}=0.49，高出 31%，存在严重过度捕捞。捕捞死亡系数 F=0.76、总死亡系数 Z=1.17，进一步威胁种群存续。LBB 分析佐证捕捞压力不可持续；$L95/L_{\infty}$=0.90 表明存在补充型过度捕捞。研究结果提示需紧急实施管理措施：降低捕捞努力量、设定体长限制、落实最优捕捞体长 Lc_opt，避免资源崩溃。

看不见的深海：通过微生物基因组学探索海洋资源与环境变化

卡罗莱娜·萨尔瓦多

中国海洋大学

深海是地球上探索程度最低的生境，具有高压、低温、寡营养与特殊地球化学特征。即便环境严苛，深海生态系统仍蕴藏代谢多样的微生物群落，主导生物地球化学循环。微生物基因组与宏基因组技术可解析微生物多样性、代谢潜能及其对自然与人为扰动的响应。报告结合马里亚纳海沟、南海冷泉、南大西洋坎波斯盆地等区域研究，对比极端环境微生物适应机制、甲烷碳循环过程与石油污染带来的群落变化，探讨生物信息学与环境基因组学的前沿应用，强调深海除矿产能源外，其基因资源、生物地球化学过程对深海生态保护意义重大。

07 其他版块相关论坛
Other Relevant Forums

青年科学家与一流期刊共生发展论坛
Young Scholars and Premier Journals: A Collaborative Growth Forum

柔性触觉传感器：感知机理与具身应用
杨来浩

QASTER：查询时刻锚定的会话感知时序证据检索
李彤

多维语义环境下多模态大模型驱动的用户界面复杂性评价方法
冯天

基于边缘 AI 的计算卸载能耗优化与隐私保护研究
王重

社会调查模拟中监督微调大语言模型的群体内协变失真诊断
蒋卓人

青年科学家飞鸟论坛
Young Scientists "B.I.R.D" Talk

从观察到证明：AI 如何知道任务无解
袁洋

青年科技型企业家圆桌论坛
Young Tech Entrepreneurs Roundtable

用于长航 eVTOL 的微型涡电动力系统
姜开春

柔性触觉传感器：感知机理与具身应用

杨来浩

西安交通大学

触觉是具身智能获取接触状态、执行物理任务和积累交互经验的重要信息来源。柔性触觉传感器能够共形集成于机器人指尖、关节与机体表面，获取载荷、形变及接触图像等信息，并通过接触响应辨识滑移、纹理和材料属性，弥补视觉在遮挡、弱光和持续接触条件下的局限。本文围绕“工作原理—性能形成—系统集成—任务应用”的主线，系统梳理电容式、压阻式、压电式、摩擦电式、光纤式、视触觉式和磁敏式七类柔性触觉传感器，比较其敏感材料、结构设计、读出方式、误差干扰及阵列化设计；进一步从物体识别与属性检测、安全交互与触觉引导、物体抓取与稳定持握、位姿调整与接触作业、触觉数据采集与机器人训练五个应用方向，分析触觉信息对判断、动作及训练的作用。在此基础上，归纳灵敏度与量程的协同优化、非线性与迟滞的建模补偿、阵列串扰与接触场重建、多维信号解耦与多模态融合、可制造性与长期可靠性，以及触觉数据标准化与模型泛化等关键问题。本文旨在建立从传感原理到具身应用的连贯分析框架，为柔性触觉传感器的选型、集成和应用验证提供参考。

QASTER:查询时刻锚定的会话感知时序证据检索

李彤

中国人民大学

针对长期会话问答中查询时刻信息利用不足、纯语义检索难以判断证据时间适用性以及关键会话可能被遗漏的问题，本文提出 QASTER，一种查询时刻锚定的会话感知时序证据检索方法。在查询时刻可获得的条件下，QASTER 以带有日期和会话标识的原始对话轮次为记忆单元，将同一查询日期用于会话级候选生成和时序证据重排，并传递至共享回答后端，以筛选与问题语义及时间条件相匹配的证据。在 LongMemEval-S 的 211 道知识更新与时序推理问题上，采用 GPT-5.4-mini 后端时，QASTER 较 NaiveRAG 的总体平均准确率提高 22.4 个百分点；在采用 Qwen3.7-Plus 进行推理与语义评分的时间增强检索对比中，较两种混合检索重排基线均提高 3.32 个百分点。

多维语义环境下多模态大模型驱动的用户界面复杂性评价方法

冯天

杭州全息智能技术研究院

大模型在用户体验设计中的应用不断拓展，为设计流程的智能化提供了新的技术支撑。然而，现有基于大模型的用户界面评价多侧重定性分析，往往忽略用户所处语义环境与多模态交互数据的综合作用，缺乏系统、可重复的量化评价方法。为此，本文提出一种多维语义环境下多模态大模型驱动的用户界面复杂性评价方法，包含三个核心模型：基于多维语义环境的用户画像构建模型、基于多模态分析的用户体验模拟模型与基于复杂性的用户界面评价模型，形成从用户建模、体验模拟到量化评价的流程。以“药管家”应用两个版本的用户界面为对象开展效度验证实验，结果表明：多模态大模型生成的虚拟用户与真实用户的复杂性评分在界面不对齐度、界面密度、颜色复杂度等核心指标上呈显著正相关，且依据评价模型建议优化后的版本界面整体感知复杂性显著低于初始版本，初步验证了方法的效度。本文研究为多模态大模型应用于界面复杂性评价提供了一种可行路径。

基于边缘 AI 的计算卸载能耗优化与隐私保护研究

王重

华东计算技术研究所

本文针对边缘 AI 联邦学习计算卸载过程中模型参数频繁交互所导致的终端能耗偏高、训练周期长、参数传输隐私风险等问题，提出一种边缘 AI 用户计算卸载能耗优化与隐私保护策略。策略基于某校园边缘计算仿真研究平台，利用用户时间维度上的周期性聚集和空间维度上的邻近分布特征，以模型测试精度为奖励指标从用户中筛选若干中继节点（relay nodes），设计用户与中继节点 D2D（Device-to-Device）通信机制将用户参与方分成若干簇，簇内用户仅与邻近中继节点交换本地模型参数，由中继节点完成与边缘云的全局聚合与更新，从而减少同一时段内直接接入边缘云的终端数量，在保证整体卸载效率的同时，大幅降低瓶颈用户对整体训练进程的影响。此外为了抑制参数交换中的隐私泄露，本文通过在模型参数中注入拉普拉斯噪声来进一步实现用户数据的差分隐私保护，并利用全局敏感度（Global Sensitivity）来调节噪声强度，在模型可用性与隐私性之间取得平衡。通过大规模实验表明，相比于几种典型联邦学习方法，所提出的策略在保持模型精度的同时，显著降低了平均模型训练时间和用户设备能耗，并提供了可证明的差分隐私保护。

社会调查模拟中监督微调大语言模型的群体内协变失真诊断

蒋卓人

浙江大学

针对大语言模型合成调查应答的现有评价偏重单变量指标、难以识别聚合一致性掩盖群体内协变失真的问题，提出一种由单变量对齐、全样本相关模式一致性和群体内相关模式保持程度构成的三层诊断框架，并以真实数据的分半稳定性作为群体内指标的经验基准，进一步结合组内与组间协变强度构成及群体内个体应答离散度定位失真来源。基于世界价值观调查第七轮测试集覆盖 65 个国家和地区的 social 信任数据，对 3 种开源指令模型及其监督微调版本进行评测。结果表明，监督微调模型的全样本相关模式一致性达到 0.86～0.89，但群体内一致性仅为 0.29～0.37，相当于各自匹配分半稳定性基准的 43%～54%；协变强度中的群体内成分占比由真实数据的 74%降至 6.5%～7.4%，群体内个体标准差降至真实值的 31%～33%。这表明，监督微调改善了单变量和聚合层面的拟合，但这种改善主要伴随群体间均值差异的复现，并未同步恢复群体内部的个体异质性和相关模式。所提框架可用于识别聚合层面高一致性可能掩盖的群体内结构失真，为大语言模型合成调查应答进入多变量统计分析前的质量评估提供依据

从观察到证明：AI 如何知道任务无解

袁洋

清华大学交叉信息研究院

对于一个新任务，如果人类尝试了很多次都失败了，会总结经验，形成理论框架，最后找到解决方案或者论证任务无解。AI 也能这样做么？我们发现，对于当前主流的推箱子游戏数据集 Arc3，GPT-6 等顶尖模型无法稳定判断一个游戏是无解的，而会浪费大量的时间和算力资源做无意义的尝试。针对这个现象，本报告提出：1.让 AI 将游戏中的种种观察提炼出基本的规则；2.在范畴论的指导下，简化规划形成最核心的基本概念；3.基于基本概念，重构游戏世界模型，并证明某个局面是否有解。这使人工智能从会尝试，到会建模、会验证、会解释，也能基于极低成本，严格论证任务的可行路径和不可行边界。

用于长航 eVTOL 的微型涡电动力系统

姜开春

浙江清华长三角研究院

目前垂直起降无人机（eVTOL）受限于电池的能量密度，飞行时间较短，形成了广泛使用的瓶颈。本报告介绍一种基于微型燃气轮机的涡电混动新型动力系统，具有高功重比，低碳或零碳排放的特点，能够解决了纯电动无人机里程焦虑，可以将飞行时间从约 25 分钟增加到约 3 小时，打破 eVTOL 的续航瓶颈，大幅度扩大无人机的服务范围，也相当大程度满足节能减排或零排放的目标。报告着重介绍姜院士团队研发一款 30 千瓦的微型燃气轮机整机的过程，包括具有国际专利的结构设计，空气轴承、异型燃烧室，净零排放的研究，和整机点火发电实验。同时介绍的还有该团队自己设计的一款新型无人机，作为在研中的涡电动力系统的演示平台。该动力系统和无人机正在走向市场。

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Selected Abstracts for WYSS 2026

人工智能与机器学习
Artificial Intelligence and Machine Learning

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人工智能赋能高校网球教学：基于计算机视觉与可穿戴设备的个性化反馈研究
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量子信息技术与量子计算
Quantum Information Technology and Quantum Computing

Towards Practical Quantum Advantage for Artificial Intelligence
Zhaokai Li

生物技术与大健康
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Association of Serum 25(OH)D Levels with Seasonal Bipolar Disorder
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BioTrace: An Accountable Self-learning Platform for Hypothesis-driven Biomedical Multi-omics Analysis
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scPCLM: A Hybrid Optimization Approach for Identifying Differentiation-associated Genes From Single-cell RNA-seq Data
Huidong Su, Zhaoyang Yuan, Guangyu Li

Engineered Nanoplatform with Dual Anti-Inflammatory and Microbiota-Modulating Actions for Targeted Therapy in Chronic Inflammatory Bowel Disease
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人工智能驱动的多模态口腔虚拟患者构建与精准诊疗
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面向健康老龄化的社区更新研究：空间—社会—生态框架与理论进展
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朱海斌

Backward propagation matters: boosting node influence identification via realistic diffusion modeling of the Abstract

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Abstract

The accurate identification of influential nodes in complex networks is crucial for understanding and controlling spreading processes. Existing probabilistic models (e.g., DR and DPP) simulate diffusion by propagating influence from lower- to higher-order neighbors and within the same order, but they overlook a key feature of real-world contagion: higher-order neighbors can also infect lower-order ones. We propose DPPB, a lightweight extension that incorporates this backward propagation mechanism without introducing tunable parameters or additional computational overhead. Evaluated on ten real-world networks under the SIR framework, DPPB consistently outperforms eleven state-of-the-art centrality measures in ranking accuracy, top-k identification, monotonicity, and spreading capability. These results indicate that backward propagation matters and that narrowing the gap between model assumptions and real diffusion dynamics is a simple yet effective strategy for advancing node-influence identification.

Presenter Biography

Xiaoyu Zhu, Ph.D. in Management, Lecturer. Main research area: complex network modeling.

人工智能赋能高校网球教学：基于计算机视觉与可穿戴设备的个性化反馈研究

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摘要:

网球运动对技术动作规范性与训练负荷精准调控有极高要求，然而当前高校网球教学普遍面临师资不足、反馈机制单一等结构性短板。传统教学过度依赖教师经验判断，难以兼顾学生个体差异与动态训练反馈。本人及课题组依托国际网联 ITF 高级教练员和国家网球一级运动员的专业经验，围绕“AI+网球教学”开展系列应用研究。在动作识别层面，采用基于 ResNet-50 姿态估计模型提取骨骼关键点，使用 PoseC3D 模型对 6 类网球子动作进行分类，Top1 准确率达 90.8%，基于动态时间规整的评分算法与教练人工评分无显著差异。在反馈机制层面，计算机视频反馈组教学效果显著优于语言反馈组及无反馈组。在负荷监控层面，引入可穿戴微技术对发球量、强度及加速度计负载进行训练与比赛周期的量化分析。上述研究在方法论层面形成了“智能识别—实时反馈—负荷调控”三位一体的网球教学辅助框架，为高校网球教学从“经验驱动”向“数据驱动”的范式转型提供了实证依据。

报告人简介：

朱庆旺，讲师，国际网联 ITF 高级教练员，国家网球一级运动员、一级裁判员，安徽省网球协会理事，合肥市新站高新区网球协会副会长。研究方向为人工智能与网球教学训练融合、大学生运动健康促进。近五年指导学生在第 29 届中国大学生网球锦标赛（华中赛区）中斩获甲组女子团体第六名，学校获评体育道德风尚奖；主持或参与高校网球教学改革课题多项，发表教学研究论文数篇。

Towards Practical Quantum Advantage for Artificial Intelligence

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Abstract

The development of AI relies on large models and massive datasets, resulting in rapidly growing computational and resource demands. Quantum computing offers a fundamentally different approach by exploiting high-dimensional Hilbert spaces and complex quantum dynamics for information processing. In this talk, I will present our recent efforts to apply quantum resources to several core artificial intelligence tasks. These include a resource-efficient quantum matrix algorithm based on resonant quantum principal component analysis for feature extraction and dimensionality reduction, as well as a quantum neural network implemented on a trapped-ion qudit processor with hybrid quantum-classical backpropagation. I will also present our recent work on experimental quantum reservoir computing, in which a nine-spin system achieved higher prediction accuracy than classical models with thousands of nodes in long-term weather forecasting. These results demonstrate complementary ways in which quantum systems can enhance artificial intelligence and open promising directions toward resource-efficient learning models, broader real-world applications, and practical quantum advantage.

Presenter Biography

Zhaokai Li is an Associate Professor at the University of Science and Technology of China (USTC). He has many years of experience in experimental research on spin-resonance-based quantum computing and quantum simulation, with extensive expertise in magnetic-resonance quantum control. His research achievements include the implementation of quantum artificial intelligence algorithms for handwritten-digit recognition, compressed quantum simulation, quantum-chemistry ground-state problems, and the solution of linear systems of equations. As first or corresponding author, he has published six papers in Physical Review Letters, as well as papers in Science Advances and other leading journals. His current research focuses on the intersection of machine learning and quantum computing, with an emphasis on developing practical quantum algorithms and implementing quantum machine-learning algorithms on quantum computing platforms to demonstrate their capabilities in solving artificial intelligence problems.

Association of Serum 25(OH)D Levels with Seasonal Bipolar Disorder

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Abstract

Vitamin D deficiency has been associated with various mood disorders, yet the seasonal patterns of serum vitamin D levels in patients with seasonal bipolar disorder (SBD) remain insufficiently understood. This cross-sectional study investigated seasonal changes in serum 25-hydroxyvitamin D [25(OH)D] levels in 160 patients with DSM-IV-diagnosed SBD compared to 24 age- and sex-matched healthy controls recruited between January 2017 and January 2018. Serum concentrations were measured using electrochemiluminescence immunoassay, with deficiency defined as <50 nmol/L, alongside the collection of demographic and lifestyle data. Results indicated that mean serum 25(OH)D concentrations showed significant seasonal variation, peaking in summer (72.00 ± 16.84 nmol/L) and reaching a nadir in winter (47.73 ± 15.97 nmol/L). Patients with SBD exhibited significantly lower serum 25(OH)D levels than healthy controls ($p < 0.001$). Furthermore, vitamin D deficiency was associated with older age, female sex, smoking history, and fewer healthy sleep habits, whereas serum levels were positively correlated with regular physical activity. These findings suggest that patients with SBD exhibit marked seasonal vitamin D fluctuations, and monitoring vitamin D status across seasons may help identify patients at increased risk of deficiency.

Presenter Biography

Jiayu Lv, Psychiatrist specializing in clinical care for older adults. Experienced in treating Alzheimer's disease and related dementia, vascular dementia, mood disorders common in older adults, cognitive decline, behavioral and psychological symptoms, insomnia, and psychiatric symptoms associated with physical illnesses in older adults.

BioTrace: an accountable self-learning platform for hypothesis-driven biomedical multi-omics analysis

Huidong Su[1], Yuhao Chen[2], Jixing Yuan[2], Ze Yu[2], Yanshuo Chen[4], Xuehao Cui[5], Jing Zhang[2], Shaoyi Zhang[2], Yexiu Gao[2], Yuefei Wu[2], Ming Chen[2*], Zeping Gui[3]*, Ke Ni[2*]

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Abstract

Multi-omics analysis is increasingly central to biomedical discovery, but translating open-ended biological questions into reproducible workflows remains difficult, especially for long-chain tasks that require many interdependent analytical steps, iterative troubleshooting and evidence-grounded interpretation . We developed BioTrace, an accountable, self-learning platform that converts fuzzy biomedical prompts into executable, dependency-aware and auditable multi-omics workflows. BioTrace coordinates multiple agents for intent interpretation, workflow planning, function-block generation or reuse, containerized execution, debugging, evidence retrieval and review, while enabling human experts to inspect and redirect analyses. Each workflow is represented as a tree of function blocks with defined inputs, outputs, parameters, dependencies, logs, provenance and review status, allowing complex questions to be decomposed into traceable analytical units, executed in dependency order, repaired locally and recursively refined through feedback-driven self-improvement. Across 40 benchmark tasks spanning eight biomedical analysis categories, BioTrace achieved a 90.0% completion rate, outperforming ablated variants and baseline systems. In a 57-run neurodegeneration campaign, BioTrace generated outputs in 41 runs and audited 2,766 candidate manuscript sentences, detecting 240 claim-integrity issues. Independent external review showed that internal review supported workflow-level quality control but remained more permissive than expert assessment, reinforcing BioTrace's expert-in-the-loop design. Case studies in renal cell carcinoma, cross-organ fibrosis and astrocytoma showed that BioTrace transforms broad or expert-specified prompts into traceable long-chain workflows, nominates biologically plausible hypotheses and improves convergence with expert reference findings through guided iteration and accumulated execution experience. Together, BioTrace provides an accountable, human-supervised framework for reproducible, testable hypothesis generation and evidence-linked multi-omics analysis.

Presenter Biography

Huidong Su is a third-year PhD student in the Department of Paediatrics and Adolescent Medicine at the Li Ka Shing Faculty of Medicine, The University of Hong Kong. He specializes in bioinformatics, with a strong technical background in artificial intelligence and machine learning, as well as expertise in multi-omics data analysis. He completed a master's programme in Applied Genomics at Imperial College London and joined The University of Hong Kong in 2024 to pursue his PhD. He is also the co-founder of Ragomics and serves as a Youth Editorial Board Member of the *Journal of Computational Genomics and Biology*.

scPCLM: A hybrid optimization approach for identifying differentiation-associated genes from single-cell RNA-seq data

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Abstract

Modeling gene expression trends along pseudotime is essential for understanding cellular differentiation, but existing non-parametric smoothers overfit local fluctuations while parametric models impose restrictive shapes and suffer from initialization sensitivity in sparse single-cell data. We introduce scPCLM, a hybrid parametric approach combining rise-peak-fall and fall-valley-rise formulations with a global-to-local differential evolution (DE) and limited-memory Broyden–Fletcher–Goldfarb–Shanno with bounds optimization strategy to enhance accuracy and interpretability. To the best of our knowledge, scPCLM is among the first likelihood-based gene-level trajectory modeling frameworks to apply DE to the optimization of parametric expression dynamics along a given pseudotime trajectory. Across simulated datasets, scPCLM achieves good false-positive control, excellent peak and valley detection, lower Akaike information criterion and Bayesian information criterion values, and improved convergence compared to existing methods. Applied to real datasets, scPCLM preserves canonical programs while uniquely identifying folate-dependent metabolic pathways and revealing activation dynamics in human. These results establish scPCLM as a robust approach for reconstructing transcriptional dynamics along pseudotime.

Presenter Biography

Huidong Su is a third-year PhD student in the Department of Paediatrics and Adolescent Medicine at the Li Ka Shing Faculty of Medicine, The University of Hong Kong. He specializes in bioinformatics, with a strong technical background in artificial intelligence and machine learning, as well as expertise in multi-omics data analysis. He completed a master's programme in Applied Genomics at Imperial College London and joined The University of Hong Kong in 2024 to pursue his PhD. He is also the co-founder of Ragomics and serves as a Youth Editorial Board Member of the *Journal of Computational Genomics and Biology*.

Engineered Nanoplatform with Dual Anti-Inflammatory and Microbiota-Modulating Actions for Targeted Therapy in Chronic Inflammatory Bowel Disease

Yimeng Fang, Da Sun*,Haoxuan zhu

Institute of Life Sciences & Biomedical Collaborative Innovation Center of Zhejiang Province, Wenzhou University, Wenzhou, P. R. China

Abstract

Inflammatory bowel disease (IBD) is a chronic gastrointestinal disorder characterized by oxidative stress, impaired antioxidant defense, and gut microbiota dysbiosis. Current therapies remain limited by insufficient efficacy and systemic side effects. Here, we developed a multifunctional nanoplatform, BG/SOD@ZIF-zc, by encapsulating superoxide dismutase (SOD) within Cu-doped ZIF-zc and coating it with Escherichia coli Nissle 1917-derived bacterial ghosts (BG) for targeted delivery. The BG coating protected the ZIF framework from rapid gastric degradation, enhanced intestinal adhesion and retention, and enabled sustained release of SOD and Zn^{2+} with trace Cu^{2+} in the intestinal milieu. The system preserved enzymatic activity under gastrointestinal conditions, scavenged reactive oxygen species, and optimized the relative composition of gut microbiota. In zebrafish models, BG/SOD@ZIF-zc alleviated intestinal inflammation, restored antioxidant enzyme activity, reduced lipid peroxidation, and improved anxiety-like behavior. Mechanistically, it reduced pro-inflammatory cytokines including IL-1β, IL-6, TNF-α, NF-κB, IL-8, and IFN-γ, decreased ROS and MDA, and normalized mucosal architecture. 16S rRNA sequencing showed restoration of microbial diversity and rebalancing of IBD-associated taxa. Transcriptomic profiling revealed reversal of IBD-associated gene expression changes, with enrichment in oxidative stress, apoptosis, DNA repair, p53 signaling, ribosome biogenesis, and RNA processing pathways. These findings highlight a dual-action strategy integrating antioxidant reinforcement and microbiota regulation, offering a promising therapeutic avenue for IBD. Further validation in mammalian models is warranted.

Presenter Biography

Haoxuan Zhu is a master's student at the Institute of Life Sciences, Wenzhou University, Zhejiang Province, China. His research focuses on the development and application of natural products, nano-drug delivery systems, and the biological utilization of alloy materials. His current project focuses on the application of natural products in chronic wounds.

人工智能驱动的多模态口腔虚拟患者构建与精准诊疗

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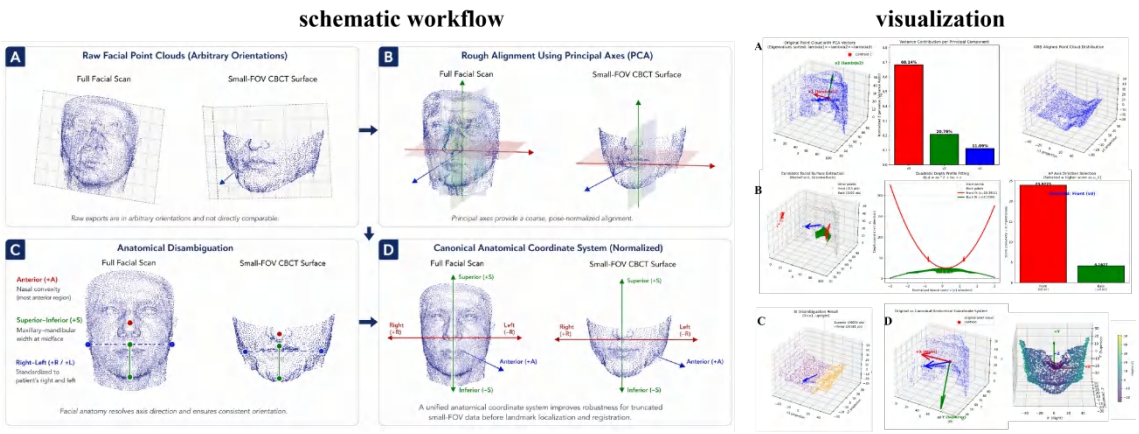
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摘要：

人工智能与多模态医学数据融合为构建患者特异性数字模型和实现精准医疗提供了新的技术路径。口腔诊疗涉及锥形束 CT、口内扫描及三维面部扫描等多源异构数据，但不同模态在空间分辨率、坐标体系及数据质量方面存在显著差异，传统人工配准和多软件处理流程效率较低，并易产生误差累积。围绕上述问题，本团队开展了人工智能驱动的多模态口腔虚拟患者构建研究。首先，建立基于消费级移动 LiDAR 的便携式三维面部扫描方法，其测量偏差为 0.945±0.765 mm，与商用三维面扫设备的 1.006±0.787 mm 相比无显著差异，实现低成本颜面三维数据获取。进一步结合人工智能辅助结构识别、三维点云特征提取及自动配准技术，实现口内扫描、CBCT 与面部扫描数据的空间融合，并系统揭示 CBCT 质量、配准策略及参考点数量对跨模态配准精度的影响，其中三点配准误差为 257.0 μm，优于三表面配准的 479.3 μm。基于多模态融合模型，进一步实现不同咬合状态下颞下颌关节空间关系的三维可视化。上述研究形成了由智能数据采集、人工智能辅助跨模态融合到患者特异性功能表征的连续技术体系，为多模态口腔虚拟患者、数字孪生及人工智能辅助精准诊疗提供了方法学基础。



图示：虚拟患者诊疗平台的构建及精度结果验证

报告人简介：

李松航，四川大学华西口腔医学院副研究员，主要从事人工智能辅助数字化口腔诊疗研究。以第一/通讯作者发表 SCI 论文 30 篇，主持国家自然科学基金等项目 11 项，获 2026 数字中国创新大赛一等奖等。

面向健康老龄化的社区更新研究：空间—社会—生态框架与理论进展

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摘要:

人口老龄化背景下，社区更新正由满足基本居住需求逐步转向促进健康老龄化与提升环境支持能力。现有研究较多从建成环境、社会参与或生态环境单一维度讨论社区健康效应，空间、社会与生态因素之间的关联机制及其对健康老龄化的综合作用仍缺乏系统认识。针对这一问题，课题组以健康老龄化与社区更新的交叉研究为基础，采用文献计量分析、知识图谱分析及 PRISMA 2020 指导的文献识别与筛选方法，对 2015~2025 年 Web of Science 核心合集与中国知网收录的相关研究进行系统梳理，共分析 1386 篇中英文文献。研究发现，相关领域的研究重点已由以设施配置和单一空间改善为主，逐步转向兼顾空间环境、社会参与和生态环境的综合干预；在此基础上，课题组构建空间—社会—生态（Spatial-Social-Ecological，SSE）框架[]，将环境干预、社会参与、生态疗愈与健康老龄化纳入统一分析体系，形成从空间干预走向综合健康支持的理论路径（图 1）。该成果拓展了社区更新与健康老龄化研究的交叉边界，为理解建成环境与社会生态因素对老年人健康支持的潜在作用提供了整合性理论视角，并可为老旧社区更新、适老化环境营造及健康导向的城市存量更新提供理论依据和研究框架。

报告人简介：

李洋，河南理工大学设计学院建筑学专业 2025 级硕士研究生，具有高校教师资格证及环境设计助理工程师。研究方向为健康老龄化、老旧社区更新与公共交往空间。参与健康老龄化社区更新研究，已发表 Frontiers in Public Health 论文 1 篇。

社区内在能力下降老年人电子健康素养现状及相关因素：一项横断面研究

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摘要：

电子健康素养是老年人有效获取、理解和应用数字健康信息的重要能力，内在能力下降可能进一步增加其数字健康服务使用障碍。本研究旨在调查社区内在能力下降老年人的电子健康素养现状及相关因素，为适老化数字健康和人工智能辅助健康管理服务设计提供依据。采用横断面研究设计，对社区内在能力中度或重度下降老年人进行调查，采用一般资料调查表、电子健康素养量表（eHEALS）及内在能力相关评估工具收集资料。最终纳入 322 名研究对象，eHEALS 得分中位数为 23.5（16.0，28.0）分。单因素分析显示，文化程度、经济状况、听力状况和内在能力下降程度与电子健康素养水平有关（P＜0.05）。多元线性回归分析显示，与小学及以下文化程度相比，初中、高中及大专及以上文化程度者 eHEALS 得分分别增加 2.89、6.96 和 9.61 分；与经济状况较差者相比，经济状况一般及以上者 eHEALS 得分更高（均 P＜0.01）；控制其他变量后，重度内在能力下降者较中度下降者 eHEALS 得分降低 2.71 分（95%CI：-5.15～-0.27，P＝0.030）。结果提示，文化程度、经济状况及内在能力下降严重程度是社区内在能力下降老年人电子健康素养的重要相关因素。数字健康及人工智能辅助健康管理服务应充分考虑老年人的教育、社会经济和功能状态，加强适老化设计与针对性支持，以降低数字健康服务使用障碍。

报告人简介：

石果鑫，硕士研究生，研究方向为老年护理、健康老龄化与数字健康，围绕社区老年人内在能力、电子健康素养及护理智能体开展研究。2026 年第 11 届“科创江苏” 创新创业大赛徐州初赛一等奖。

仑卡奈单抗治疗阿尔茨海默病患者脑结构体积纵向变化的 MRI 研究

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摘要:

探讨阿尔茨海默病（AD）患者接受仑卡奈单抗治疗过程中脑结构体积的纵向变化特征。纳入 13 例接受仑卡奈单抗治疗的 AD 患者，共获得 48 次颅脑 MRI 检查，随访时间点包括治疗前基线及治疗后 1、3、6、12 个月。采用 FreeSurfer 8.2 进行脑区自动分割及体积定量。应用线性混合效应模型分析各脑区体积随时间的变化，以时间为固定效应、颅内容积为协变量、患者为随机截距，并采用 Benjamini-Hochberg 法进行 FDR 多重比较校正；进一步将时间作为分类变量比较各随访时间点与基线的差异，并进行敏感性分析。FDR 校正后，7 个脑区呈显著纵向变化（均 $q<0.05$）。双侧侧脑室、双侧下角侧脑室及第三脑室体积随时间显著增加，左侧海马体积显著减少。治疗 12 个月时，左、右侧脑室体积较基线分别增加约 10.8%和 12.2%，左、右侧下角侧脑室分别增加约 19.3%和 16.0%，第三脑室增加约 8.7%，左侧海马体积减少约 4.2%。逐一剔除单个受试者后，各显著脑区效应方向均保持一致。仑卡奈单抗治疗期间，AD 患者表现出以脑室扩大伴局部脑实质体积减少为特征的纵向结构重塑，其中脑室系统变化较一致。该现象提示仑卡奈单抗治疗过程中脑容量变化可能具有不同于单纯神经退行性萎缩的影像学特征，其潜在机制及与 Aβ清除、ARIA 和临床疗效的关系仍需进一步验证。

报告人简介：

运岩，山东大学齐鲁医院，主治医师。2015-09 至 2019-12，山东大学，齐鲁医学院临床医学，博士。主要研究方向为神经退行性疾病的分子病理机制，主持国家自然科学基金一项，在 *Mol Psychiatry*，*Cell Death Dis* 等杂志上发表多篇论文。

增强现实技术(AR)联合五行音乐疗法对于局部麻醉下乳腺微创手术患者围手术期焦虑的干预研究：一项单中心、随机对照、单盲的临床试验

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摘要:

目的：评价在局部麻醉清醒状态下，增强现实技术（AR）联合五行音乐疗法对接受乳腺微创手术患者围手术期焦虑的干预效果，并与 AR 联合西方音乐及常规护理进行比较，同时观察患者血压与心率变异率等生理应激反应的变化。**方法：**采用单中心、随机对照、单盲试验设计。将 100 例于局麻下行乳腺微创手术的术前焦虑患者，随机分为三组：A 组（AR+五行音乐）、B 组（AR+西方音乐）及 C 组（常规护理）。A、B 两组于术前接受 AR 视频宣教，并于术中（患者清醒状态下）同步接受 AR 舒缓场景与对应类型音乐干预；C 组接受常规护理。主要结局指标为医院焦虑抑郁量表焦虑分量表（HADS-A）评分变化，术中血压与心率的变异率。次要指标包括其他术中生理指标、疼痛评分及配合度。**结果：**结果显示，与 C 组相比，A、B 两组患者术后各时点 HADS-A 评分显著降低（$P<0.01$），且术中血压与心率变异率更为稳定，生理应激反应更平缓，疼痛评分更低，配合度更高。A 组在术后 1 周的焦虑缓解程度可能优于 B 组（$P<0.05$）。**结论：**本研究预期证实，在局麻清醒手术这一关键应激时段，AR 联合音乐疗法是一种高效的非药物干预策略，可显著缓解焦虑并稳定术中生理波动。五行音乐疗法可能因其文化适配性与辨证施治特点，在促进术后情绪恢复方面具有独特价值。

报告人简介：

吴小珍，硕士在读，副主任护师，广州医科大学附属妇女儿童医疗中心妇婴手术室护士长，广州市卫健委优秀人才。从事妇产科围术期护理与创新转化研究，主持省市级课题 4 项，获省护理学会科技奖三等奖、新加坡发明展金奖等，发表核心论文多篇，授权专利 30 余项。

细胞外囊泡与金属有机框架协同体系的构建及生物医学应用

吴鑫，徐培烨[1]，何家轩[1+]，孙达 [2*]

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摘要:

围绕疾病精准诊疗与组织修复中传统纳米载体靶向性不足、易被免疫清除，以及天然细胞外囊泡稳定性、载荷能力和体内持续作用受限等问题，本课题组持续开展细胞外囊泡生物功能及工程化应用研究。前期以创面修复为切入点，系统梳理细胞外囊泡携带 miRNA、蛋白质和脂质等活性成分介导细胞间信息传递的作用规律，明确其可参与炎症调控、细胞增殖迁移、血管生成及细胞外基质重塑；进一步总结乳源细胞外囊泡来源丰富、产量较高、生物相容性良好和低免疫原性等特点，为发展可规模化的无细胞治疗载体提供理论依据。在此基础上，重点聚焦细胞外囊泡与金属有机框架（MOFs）协同体系，系统归纳其复合形式、制备策略、作用机制及疾病诊疗应用，提出利用细胞外囊泡的天然靶向、免疫逃逸和跨生物屏障能力，与 MOFs 的高比表面积、高负载、结构可调及刺激响应控释特性相耦合，形成“靶向递送—结构保护—持续释放—信号放大”的协同机制。通过系统梳理 EV-MOF 体系在药物递送、生物传感与成像、肿瘤及炎症性疾病治疗、创面修复、骨再生和抗感染等领域的应用，进一步归纳其多功能协同优势，并从规模化制备、批次一致性、体系稳定性、生物安全性及体内作用机制等方面明确了临床转化亟待解决的关键问题。相关工作系统梳理了细胞外囊泡从天然生物学功能到工程化协同应用的发展脉络，为其在精准诊疗、无细胞治疗及再生医学中的进一步研究与应用提供了理论依据和研究思路。

报告人简介：

吴鑫，温州大学在读硕士研究生，获温州大学一等奖学金，主要研究方向为基于细胞外囊泡与金属材料复合体系的糖尿病创面修复研究，目前主要围绕该研究方向开展相关科研工作。

仿生手性生物材料研发与骨缺损修复

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摘要:

2021 年上海交通大学携手 Science 杂志发布了“新 125 个科学问题”。其中有一问就是：为什么生命需要手性？在生命体中，氨基酸、DNA、蛋白质、多糖、细胞膜、细胞乃至这个生命体结构，都是手性的。因此手性是生命体的基本属性之一。有一个经典案例，沙利度胺（一种镇静剂），R 构型具有减轻孕吐反应的作用，而 S 构型则导致畸形。这是生命体的手性系统对外界手性物质的选择性识别作用导致的。因此，我以此为理论基础，开发设计仿生手性生物材料。通过手性材料微环境识别匹配作用，实现组织修复和疾病治疗。首先，聚焦于骨修复材料领域。目前骨修复材料结构微环境与天然骨结构不匹配，导致骨长入和骨整合受限，且结构活性不共存，无法有效治疗骨缺损。因此，急需开发一种结构功能匹配、且具有骨引导和骨诱导能力的生物材料用于骨修复。针对上述问题，我仿生天然骨矿物的手性多级结构创制了手性多级结构生物陶瓷材料。该材料兼具手性多级结构匹配和成骨活性，可有效实现骨修复。

报告人简介：

周超，上海交通大学医学院附属第六人民医院副研究员。致力于骨组织结构及手性生物材料、天然生物材料和组织损伤修复的研究，担任 *Biomaterials Translational*、*EngMedicine* 青年编委，中国医疗器械行业协会增材制造医疗器械专业委员会工学专家。主持国家自然科学基金项目，上海市超级博士后人才项目等。作为第一作者/通讯作者在 *Advanced Materials*、*Bioactive materials* 等期刊发表 SCI 论文 28 篇，申请国家发明专利 30 余项，其中授权 12 项。受邀在 2025 中国材料大会，2025 世界青年科学家峰会，2025 国际组织工程和再生医学大会，2025 第十四届先进陶瓷国际会议等高水平学术会议上进报告交流。

Sustainable Valorisation of Argan Press Cake (Argania spinosa L.): Nutritional and Technological Quality of Enriched Wheat Bread

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Abstract

The sustainable valorization of agro-industrial by-products represents a promising strategy for reducing food-processing waste while developing innovative and nutritionally valuable food ingredients. Argan oil production generates substantial amounts of argan press cake (APC), a nutrient-rich by-product containing proteins, dietary fiber, minerals, and other valuable constituents. However, its application in human nutrition is limited by its high saponin content, which is responsible for bitterness and may affect nutritional quality.This study investigated a simple thermal pre-treatment of APC to reduce antinutritional compounds and evaluated its potential incorporation into wheat flour for bread production. Treatment with hot distilled water substantially reduced saponin content while preserving its nutritional value and significantly reducing phytic acid content. Treated APC was subsequently incorporated into wheat flour at substitution levels of 5, 10, 15, and 20%. The resulting composite flours exhibited improved nutritional characteristics, particularly higher protein content, while incorporation levels of up to 10% maintained or improved technological properties relevant to breadmaking.These findings demonstrate that appropriately treated argan press cake can be transformed from an underutilized agro-industrial by-product into a promising functional food ingredient. Its incorporation into bread provides a practical approach to improving nutritional value while contributing to waste reduction, resource efficiency, and the circular bioeconomy of the argan value chain. This strategy illustrates how locally available biological resources can support more sustainable and innovative food systems.

Presenter Biography

Prof. Dr. Badr Eddine Kartah is a Full Professor of Chemistry at Mohammed V University in Rabat, Morocco, and Head of the Natural Products Chemistry research team. His research focuses on natural products chemistry, phytochemistry, bioactive compounds, food quality, and the sustainable valorization of plant resources and agro-industrial by-products. He has extensive experience in research, teaching, doctoral supervision, and international scientific cooperation. He is also President of the Averroès Foundation for Scientific Research, Innovation and Sustainable Development and an Affiliate Member of TWAS Arab Regional Partner.

Efficient biodegradation and detoxification of 6:2 fluorotelomer sulfonic acid by Phanerochaete chrysosporium: Insights into enzymatic mechanisms and reduced ecotoxicity

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Abstract

Per-and polyfluoroalkyl substances (PFAS) are persistent “forever-chemicals”. 6:2 fluorotelomer sulfonic acid (6:2 FTSA), a widely-used short-chain PFAS substitute, is frequently detected in aquatic environments and exhibits hepatotoxic, immunotoxic and reproductive toxicity. Conventional physicochemical remediation suffers from high-energy consumption and secondary pollution. This work investigated the biodegradation and detoxification capacity of white-rot fungus Phanerochaete chrysosporium towards 6:2 FTSA, as well as its underlying molecular mechanism. Degradation assays, CYP450 inhibitor (ABT) experiments, transcriptome-qPCR, LC-Q-TOF-MS metabolite identification and multi-level zebrafish toxicological evaluation were performed. The results showed P. chrysosporium achieved 99.97 % removal of 6:2 FTSA within 7 days. Extracellular manganese peroxidase (MnP) initiated oxidation-defluorination, while intracellular CYP450 dominated desulfonation and hydroxylation for complete transformation. Transcriptomic analysis revealed pollutant-triggered reprogramming of fungal redox, lipid and energy-metabolism pathways. After fungal biotransformation, oxidative injury, hepatic-brain lesions and anxiety-like abnormal behaviours in zebrafish were largely alleviated, confirming effective detoxification. This study clarifies the dual-enzyme synergistic degradation mechanism and provides theoretical support for green bioremediation of PFAS-contaminated water.

Presenter Biography

Xintao Gou is an undergraduate student at College of Life and Environmental Sciences, Wenzhou University. His main research interest focuses on environmental microbial remediation and ecotoxicological assessment of per- and polyfluoroalkyl substances. He participates in research on fungal degradation of emerging organic pollutants.

PVD 技术现状及其在汽车内饰件上的应用

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摘要:

PVD（Physical Vapor Deposition，物理气相沉积）技术因外观质感好且环境污染小，正逐步替代传统电镀工艺成为汽车内饰件表面金属质感的主流方案。本文系统介绍了 PVD 的三种基本类型——真空蒸镀、溅射镀和离子镀的技术原理与特点。重点对比了真空蒸镀中的电阻蒸发镀和电子束蒸发镀以及溅射镀中的磁控溅射在工业中的适用性。与传统塑料电镀相比，PVD 具有金属细腻质感、色彩丰富、基材选择广、可实现半透光效果且无重金属污染等优点；但也存在涂层附着力和耐磨耐蚀性相对不足等缺点，且成本较高（小件高 50%~100%，大件高 30%~50%）。详细阐述了典型 PVD 工艺流程：包括镀前处理、装配、清洗、等离子活化、UV 底漆喷涂（厚度 8~12 μm）、UV 照射烘干、真空镀膜、中漆调色（1~2 μm）、UV 照射烘干、UV 透明面漆（10~15 μm）、UV 照射烘干、成品等 12 道工序，并指出溅射镀可根据基材和靶材的特点省略其中底漆工序。在试验验证方面，本文归纳了硬度、附着力、耐溶剂、湿热及冷热冲击等典型性能测试，结果表明经优化工艺制备的 PVD 镀层均能满足汽车内饰件的使用要求。最后，结合极氪 001、领克 08 等车型的应用案例及专利，展望了 PVD 在汽车内饰的应用前景，未来可从提升镀膜结合力、开发多功能镀膜材料及降低设备成本等方面开展工作，以推动其规模化应用。

报告人简介：

黄庆达，硕士，高级工程师，入选温州市瓯越英才计划青年科技领军人才，温州市 D 类人才，浙江长江汽车电子有限公司副总监，从事汽车电子及其表面工艺和系统集成的研究工作，荣获浙江机械工业科技奖三等奖 4 次。

光热增强类过氧化物酶活性的镍铁纳米酶用于耐甲氧西林金黄色葡萄球菌感染伤口治疗

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摘要：

耐甲氧西林金黄色葡萄球菌感染与生物膜形成使传统抗生素穿透差、耐药率高，临床创面修复困难。现有光热/纳米酶体系常受近红外一区穿透不足或类过氧化物酶（POD-like）活性偏低限制，单一疗法难以彻底清除耐药菌生物膜[2]。针对内源性 H_2O_2 不足、催化效率有限等短板，本研究以柚子皮为碳源经氮掺杂碳化构建镍铁双金属纳米酶 NiFe-N-C，在 1064 nm 近红外二区照射下协同光热治疗与化学动力学治疗：光热升温增强 Fenton-like 过程，催化 H_2O_2 产生大量羟基自由基（·OH）[1]。标志性结果显示，NiFe-N-C 光热转换效率 49.23%，体外对 MRSA 杀菌率 >99% 并近完全清除生物膜；小鼠皮下脓肿模型中创面面积缩至 11.1%、菌落数 0.8%，同时促进巨噬细胞 M1→M2 极化、上调 CD206/IL-10、诱导 CD31 血管新生与胶原沉积。相较氧空位 NiO_x 等平台，该材料在 200 μg/mL 下细胞活性良好、溶血率 <5%，体内无显著系统毒性[3]。该工作确立“光热增强纳米酶催化”这一非抗生素协同新范式，为耐药菌创面、慢性溃疡及植入物周围感染提供了可转化的抗感染—促修复思路[1-3]。

报告人简介：

王馨露，温州大学硕士研究生，主要研究方向：金属纳米酶和植物外囊泡对创面修复能力的相关研究。

氨基功能化介孔二氧化硅纳米载体递送 siIL-31 干预创面愈合期瘙痒

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摘要:

创面愈合期瘙痒是皮肤修复过程中常见且缺乏有效干预的临床问题，持续瘙痒及反复搔抓不仅明显降低患者生活质量，还可造成继发性组织损伤、感染及愈合延迟，因此亟需兼顾止痒效果与创面修复安全性的精准干预策略[1]。白细胞介素-31（IL-31）是连接创面局部免疫反应与瘙痒感觉的重要介质，其持续升高可驱动瘙痒相关神经信号，因此降低 IL-31 表达有望从源头减弱瘙痒[2][3]。小干扰 RNA（siRNA）具有序列特异性基因沉默能力，为精准抑制 IL-31 提供了潜在手段。然而，裸 siRNA 易被核酸酶降解、细胞摄取效率低且局部稳定性不足，限制了其在创面环境中的应用 [4]。针对上述问题，本研究构建了氨基功能化介孔二氧化硅纳米颗粒（MSN-NH_2）负载 siIL-31 的局部递送体系（siIL-31@MSN-NH_2），并系统评价其理化性质、生物相容性及创面止痒作用[5]。结果表明，MSN-NH_2具有规则介孔结构、较高比表面积及适宜表面电荷，可高效吸附 siIL-31，实现在创面局部的持续释放，增强其抗 RNase 降解能力并促进细胞摄取，且体内外均表现出良好生物相容性。在小鼠皮肤创面模型中，siIL-31@MSN-NH_2显著降低创面组织 IL-31 mRNA 及蛋白表达，下调 STAT3 磷酸化水平，并明显减少搔抓行为。进一步分析显示，该体系可调节早期炎症因子表达，并在后期呈现更高的 CD206/iNOS 比值，同时未见明显再上皮化受损。综上，本研究建立了一种面向创面愈合期瘙痒的局部 siRNA 纳米递送策略，为 IL-31 精准干预及核酸药物在创面治疗中的应用提供了新的实验依据，并为纳米材料在创面症状精准调控中的应用提供了新的研究思路。

报告人简介：

郑佳啸，温州医科大学第二临床医学院学生，关注纳米材料生物医学应用，现聚焦创面瘙痒与 siRNA 递送研究。以第一作者发表 SCI 论文 1 篇，参与数篇，主持并结题国家级大学生创新创业训练计划、浙江省新苗人才计划多项。

高校转型视角下大学生运动员创业支持体系研究—以亚利桑那州立大学为例

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摘要：

当前我国高等教育迈入普及化阶段，学生运动员的就业与创业问题，成为各高校亟待破解的现实难题。本研究以美国亚利桑那州立大学为个案，以场域理论为出发视角，系统分析亚利桑那州立大学在运动员创业支持方面的做法。研究发现，亚利桑那州立大学通过搭建场域联动平台，浸润校园文化和竞技精神，配置经济—社会—象征—文化多维资本等举措，形成了较为完整的学生运动员创业支持体系。然而，这套体系也存在各场域之间结构不对称、惯习内化存在形式化倾向、资本分化显现马太效应等矛盾。借鉴其经验，我国高校应消解育人场域壁垒以重构行动者关系，引导学生内在品质向创业心智跃迁，健全普惠性资本流通再生产通道帮助学生运动员实现高质量创业。

报告人简介：

姓名：冀乐 院校：温州大学 学历：硕士研究生 主要研究方向：比较创业教育学

生成式人工智能时代的人机协同创作与责任治理：著作权制度的适应性回应

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摘要：

生成式人工智能正在改变知识生产与文化创作，也使作者身份、权利配置与责任承担面临新的制度问题。本文以人工智能生成内容的著作权保护为中心，考察模型设计、训练安排、平台运营、提示输入、素材选择、反复生成及输出筛选中的人类贡献，分析如何在鼓励技术创新的同时，维持创作事实、权利归属与责任承担之间可解释的联系。本文重点讨论：当系统能够在较少直接人工干预下形成具有表达性的内容时，应如何识别具有法律意义的人类创作贡献，并为各参与者配置可预见的权利与责任。本文认为，仅以程序员或最终用户与输出之间的技术距离分配权利，难以反映生成式生产的分布结构；应结合创作意图、实质控制与事前可预测性，评估模型设计者、平台及用户的选择如何共同塑造表达。制度上，可依据人类贡献与控制程度判断可保护的表达及其权利主体，并以明确约定协调分布式贡献；实际控制相关权利的主体还应承担相应说明与治理义务。署名和来源披露应如实呈现人工智能参与，避免将机器生成内容未经说明地归于特定自然人。本文的规范法学分析旨在平衡原创表达保护、公众知情、市场诚信与可持续创新，为生成式人工智能版权治理提供更具可预测性和可问责性的制度框架。

报告人简介：

陆以恒，伦敦玛丽女王大学法学博士研究生、大曼彻斯特大学法学院助理教授，国家公派博士生。研究人工智能法与知识产权法，已发表 4 篇英文同行评审论文（CLSR、EIPR），曾获 EPIP 优秀论文奖。

AI 时代国际青年生涯 ACLAP 模型

——双轴生成与生命成全

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摘要:

基于课题组对就业能力、生涯发展和人工智能时代学习方式的研究，针对 AI 时代全球青年生涯发展面临的职业路径持续重构、技能更新周期缩短、传统生涯理论解释力不足等挑战，本课题组提出 AI 时代国际青年生涯 ACLAP 模型。该模型由横轴觉知（Awareness）、驾驭（Capability）、生长（Learning）、建构（Agency）、成全（Purpose）五个维度的动态循环和纵轴生命发展、关系拓展、价值实现的纵向锚点组成，将生涯发展理解为持续循环生成。生涯发展可以概括为从觉知到驾驭、到生长、到建构、到成全的循环过程，每一轮循环之后进入下一轮，循环的整体遵循生命发展、关系拓展与价值实现的方向。模型拓展了当代生涯理论将参照系限定于劳动力市场之内的解释边界，超越了适应、就业或个体意义层面的目的论，为持续发展提供超越劳动力市场漂移的纵向锚点。通过引入生命、关系、价值三个纵向层次，将参照系扩展至生命整体、关系网络与价值结构，形成横向持续生成与纵向生命成全的双轴结构，在时间、技术与目的三个方面推进了既有理论。该模型为 AI 时代全球青年生涯发展提供文化多样的阐释路径，可支持生涯教育转向持续生涯发展教育、高校就业指导、AI 教育及社会支持体系调整，为不同文化语境中的青年生涯支持提供更具包容性的框架。

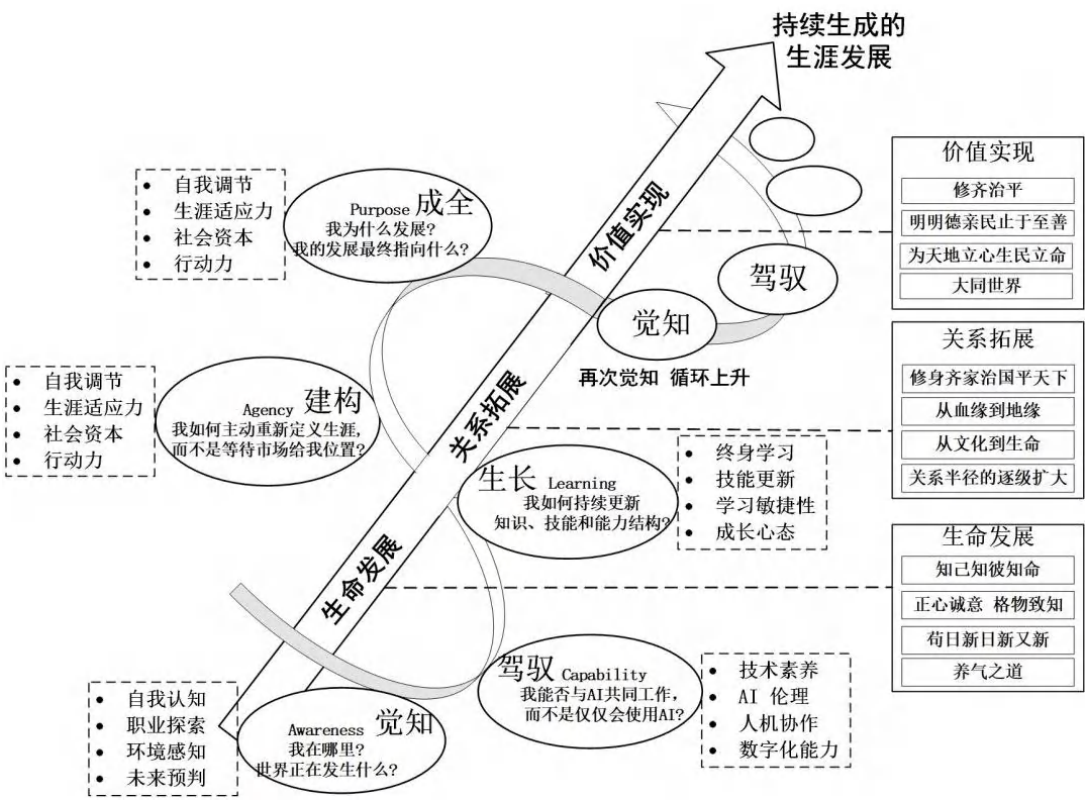


图 1 AI 时代青年生涯发展 ACLAP 模型图

表 1 五维模型各维度理论来源表

维度	核心问题	理论来源	中国文化来源
觉知 Awareness	认知自我与环境	Super 探索阶段；OECD 职业准备度；ILO 自我反思	知己知彼；知命；吾生也有涯
驾驭 Capability	与 AI 协同共处	UNESCO AI 能力框架；ILO AI 素养三域；WEF 技术素养	以道驭术；道器分层；养气
生长 Learning	持续更新能力	ILO 终身学习；WEF 技能不稳定性	苟日新日日新；教育即修养
建构 Agency	主动创造路径	Savickas 生涯适应力；Fugate 个人适应性	知行合一；修齐治平
成全 Purpose	确定发展方向	Savickas 生命主题；ILO 体面劳动	修齐治平；为天地立心；止于至善

报告人简介：

彭晓梅，华东师范大学教育学部博士研究生，国家奖学金获得者。研究方向为教育哲学与交叉学科研究范式。近五年在 SSCI 期刊发表论文，代表作《可为良相，可为良医：人工智能时代再谈东方科研范式》及 The Dao-Xiang-Qi Layered Interconnectedness Model: A Chinese Epistemic Foundation for Transdisciplinary Knowledge Integration。

贾利军，心理学博士，华东师范大学经济与管理学院教授、博士生导师，中国管理 50 人成员，上海市政府重大行政决策咨询论证专家，国务院就业工作领导小组办公室首批入库专家。获“上海市最美就业服务专家志愿者”称号。主要研究人力资源开发与就业能力理论，近年聚焦 AI 时代青年生涯持续发展研究。

科研创新与产业创新深度融合：青年科技人才创新创业的实践探索

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摘要:

在人工智能加速进入制造业的背景下，如何在技术创新、产业应用、标准规范制定与青年人才发展之间建立协同机制，成为全球科技治理面临的重要议题。纺织等传统制造业具有工艺复杂、质量缺陷类型多、数据标准不统一和高度依赖人工经验等特点，通用人工智能技术直接落地面临场景泛化、可信决策和人机协同等短板。针对上述问题，本项目以纺织品智能质检为切入点，构建“精密光学成像+行业知识图谱+AI 垂直大模型”的工业质检智能体技术路线：利用多谱段光源、多角度成像与缺陷形成机理，建立纺织行业复杂表面缺陷的高质量数据；结合垂直场景标签数据与工艺机理，开发面向纺织行业的缺陷识别、评价与辅助决策的混合模型；进一步通过与垂直场景用户企业深度合作，将工业质检智能体嵌入来料、生产在线和成品等各工序环节，并以标准制定推动技术、数据和质量评价规则协同。研制的智能检测装备产品和解决方案已在纺织面料、人造革合成革制造行业批量出货落地应用。研究表明，青年科学家参与产业创新不仅能够推动新兴 AI 技术从实验室走向真实生产场景，也可通过标准化、产学研协同和创业实践参与科技治理规则建设。该实践为传统产业智能化转型升级提供了技术路径，也为青年科技人才在全球科技治理、创新创业与职业发展之间实现跨界协同提供了案例参考。

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