

Information of QMBC2026

Schedule

2026.04.09 Onsite registration (14:00~21:00)
2026.04.10~12 Tutorial Lectures and Research talks
2026.04.13 Departure

Workshop Venue

BEIJING RONGTONG YUANWANGLOU HOTEL (北京融通远望楼宾馆)

No. 57 North 3rd Ring Middle Road, Haidian District, Beijing (北京市海淀区北三环中路 57 号)

Accommodation

BEIJING RONGTONG YUANWANGLOU HOTEL (北京融通远望楼宾馆)

BEIJING MUDAN HOTEL (北京牡丹宾馆)

Advisory Committee

Hai-Qing Lin (Zhejiang University)

Zhong-Yi Lu (Renmin University of China)

Gang Su (Institute of Theoretical Physics, Chinese Academy of Sciences)

Xiao-Qun Wang (Zhejiang University)

Tao Xiang (Institute of Physics, Chinese Academy of Sciences)

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Lei Wang (Institute of Physics, Chinese Academy of Sciences)

Shuo Yang (Tsinghua University)

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Tianxing Ma (Beijing Normal University)
Hui Shao (Beijing Normal University)
Fengjie Ma (Beijing Normal University)
Ying Liang (Beijing Normal University)
Haibo Sang (Beijing Normal University)

Workshop Secretary

Yunqi Peng (Beijing Normal University)

Invited Lecturers (listed in alphabetical order)

Frank Pollmann
Congjun Wu

Technical University of Munich
Westlake University

Invited Speakers (listed in alphabetical order)

Nick Bultinck	Ghent University
Chao Cao	Zhejiang University
Gang Chen	Peking University
Ji Chen	Peking University
Natanael C. Costa	Universidade Federal do Rio de Janeiro
Xinyang Dong	Institute of Physics, Chinese Academy of Sciences
Zhijie Fan	University of Science and Technology of China
Emanuel Gull	University of Michigan
Huaiming Guo	Beihang University
Juraj Hasik	University of Zurich
Toshiya Hikihara	Gunma University
Shijie Hu	Beijing Computational Science Research Center
Yifan Jiang	ShanghaiTech University
Wei Li	Institute of Theoretical Physics

Gang Li	ShanghaiTech University
Zhendong Li	Beijing Normal University
Zixiang Li	Institute of Physics, Chinese Academy of Sciences
Lu Liu	Beijing Institute of Technology
Zihong Liu	Fudan University
Gaopei Pan	Julius-Maximilians-Universität Würzburg
Lode Pollet	Ludwig-Maximilians-Universität München
Didier Poilblanc	University of Toulouse
Dario Poletti	Singapore University of Technology and Design
Mingpu Qin	Shanghai Jiao Tong University
Pinaki Sengupta	Nanyang Technological University
Jun Takahashi	The University of Tokyo
Atsushi Ueda	Ghent University
Hiroshi Ueda	Osaka University
Manuel Weber	Technische Universität Dresden
Zhenjiu Wang	Lanzhou University
Zhiyu Xiao	Institute of Physics, Chinese Academy of Sciences
Zhiyuan Xie	Renmin University of China
Xiaoyan Xu	Shanghai Jiao Tong University
Yuanfeng Xu	Zhejiang University
Zheng Yan	Westlake University
Qi Yang	University of Amsterdam
Shuo Yang	Tsinghua University
Zhiping Yin	Beijing Normal University
Xuejia Yu	The Eastern Institute of Technology, Ningbo

Program

Thursday, 9 April 2026		
Registration at Beijing Rongtong Yuanwanglou Hotel lobby, 14:00-21:00		
Friday, 10 April 2026		
Registration at Beijing Rongtong Yuanwanglou Hotel lobby, 08:30-21:00		
Tutorial Lecture, Chair: Chao Zhang (Anhui Normal University)		
09:00-10:20	Congjun Wu (Westlake University)	Sign-problem free quantum Monte Carlo simulation on strongly correlated fermion systems
10:20-10:50	Tea Break	
Tutorial Lecture, Chair: Chen Cheng (Lanzhou University)		
10:50-12:10	Frank Pollmann (Technical University of Munich)	Introduction to Tensor-Network Methods
12:10-13:30	Lunch	
14:20-14:30	Welcome and opening by Zhen Kang (vice president of Beijing Normal University) Gang Su (Institute of Theoretical Physics, Chinese Academy of Sciences)	
Session 1	4 talks, Chair: Rong Yu (Renmin University)	
14:30-14:50	Lode Pollet (Ludwig-Maximilians-Universität München)	Quantum Monte Carlo Simulation of Many-body physics with Rydberg systems: from supersolids to spin liquids
14:50-15:10	Zheng Yan (Westlake University)	Bipartite Reweight-Annealing Framework for Quantum Monte Carlo: Efficient Computation of Entanglement Entropy and Negativity, Quantum Magic and Off-Diagonal Measurements
15:10-15:30	Jun Takahashi (The University of Tokyo)	Proving polynomial-time mixing of the Quantum Monte Carlo method
15:30-15:50	Zhenjiu Wang (Lanzhou University)	Dissipation-induced bulk and boundary criticality in the Haldane chain
15:50-16:20	Tea Break	
Session 2	4 talks, Chair: Honggang Luo (Ningbo University)	
16:20-16:40	Shuo Yang (Tsinghua University)	Quantum criticality in open quantum systems from the purification perspective
16:40-17:00	Atsushi Ueda (Ghent University)	TNR approach to two-dimensional quantum systems at finite temperature

17:00-17:20	Zhiyuan Xie (Renmin University of China)	Grassmann tensor network study on the single-flavor Gross-Neveu-Wilson model
17:20-17:40	Hiroshi Ueda (Osaka University)	Variational Quantum Partial SVD with Orthogonality Correction: High-Precision Entanglement Spectra from Shallow Circuits
18:30-19:30	Dinner	

Saturday, 11 April 2026

Session 3	4 talks, Chair: Wei Zhu (Westlake University)	
09:00-09:20	Wei Li (Institute of Theoretical Physics)	Probing the Spin Seebeck Effect in a Triangular-Lattice Spin Supersolid via Thermal Tensor Networks
09:20-09:40	Frank Pollmann (Technical University of Munich)	Isometric Tensor Networks
09:40-10:00	Dario Poletti (Singapore University of Technology and Design)	Quantum-Inspired Computing and Beyond
10:00-10:20	Juraj Hasik (University of Zurich)	Simulating fermionic fractional Chern insulators with infinite projected entangled-pair states
10:20-10:30	Photo	
10:30-10:50	Tea Break	
Session 4	4 talks, Chair: Long Zhang (University of Chinese Academy of Sciences)	
10:50-11:10	Manuel Weber (Technische Universität Dresden)	Symmetry-enhanced pseudo-first-order transition from competing Dirac masses
11:10-11:30	Lu Liu (Beijing Institute of Technology)	Superconductivity and Charge Density Wave in the Holstein Model on the Penrose Lattice
11:30-11:50	Natanael C. Costa (Universidade Federal do Rio de Janeiro)	The Su-Schrieffer-Heeger as a playground for correlated phases
11:50-12:10	Huaiming Guo (Beihang University)	Quantum Monte Carlo studies of diverse strongly correlated Hamiltonians
12:10-13:30	Lunch	
13:30-14:30	Poster Session	
Session 5	4 talks, Chair: Hantao Lu (Lanzhou University)	
14:30-14:50	Yifan Jiang (ShanghaiTech University)	Quantum phase diagram of hole-doped Hubbard model on diagonal square lattice

14:50-15:10	Mingpu Qin (Shanghai Jiao Tong University)	Classically simulatable quantum many-body states
15:10-15:30	Shijie Hu (Beijing Computational Science Research Center)	Spinon Singlet: Microscopic Mechanism of d-Wave Pairing in a Partially-Filled Stripe
15:30-15:50	Zhendong Li (Beijing Normal University)	Ab initio simulation of strongly correlated molecular systems using tensor network and neural network quantum states
15:50-16:20	Tea Break	
Session 6	4 talks, Chair: Hanghui Chen (NYU Shanghai)	
16:20-16:40	Zhiping Yin (Beijing Normal University)	Correlation tuned Fermi-arc topology in a Weyl ferromagnet
16:40-17:00	Yuanfeng Xu (Zhejiang University)	Correlation-driven Heavy Weyl Fermion State in CeRu ₄ Sn ₆
17:00-17:20	Chao Cao (Zhejiang University)	Possible spin triplet superconductivity due to altermagnetic spin fluctuations
17:20-17:40	Gang Li (ShanghaiTech University)	Obstructed Mott insulator in layered Nb ₃ I ₈
18:30-19:30	Dinner	

Sunday, 12 April 2026		
Session 7	4 talks, Chair: Fan Yang (Beijing Institute of Technology)	
09:00-09:20	Xinyang Dong (Institute of Physics, Chinese Academy of Sciences)	Deep variational free energy for dense hydrogen calculations
09:20-09:40	Xuejia Yu (The Eastern Institute of Technology, Ningbo)	Topological physics in quantum critical systems
09:40-10:00	Emanuel Gull (University of Michigan)	Compact Representation, Compression, Continuation, and Spectra of Response Functions in Time and Frequency
10:00-10:20	Gang Chen (Peking University)	Magnetotopological mechanics in Maxwell lattice frustrated Mott insulators
10:20-10:50	Tea Break	
Session 8	4 talks, Chair: Yuanyao He (Northwest University)	
10:50-11:10	Zixiang Li (Institute of Physics, Chinese Academy of Sciences)	Preempting fermion sign problem: Unveiling quantum criticality through nonequilibrium dynamics in imaginary time
11:10-11:30	Xiaoyan Xu (Shanghai Jiao Tong University)	Resolving Quantum Criticality in the Honeycomb Hubbard Model

11:30-11:50	Gaopei Pan (Julius-Maximilians-Universität Würzburg)	Orbital-Selective Mott transition in a U(1) gauge model of the Kondo lattice: a Quantum Monte Carlo study
11:50-12:10	Zhiyu Xiao (Institute of Physics, Chinese Academy of Sciences)	Auxiliary-field quantum Monte Carlo with variational auxiliary-field quantum Monte Carlo trial wave functions
12:10-13:30	Lunch	
13:30-14:30	Poster Session	
Session 9	4 talks, Chair: Daoxin Yao (Sun Yat-sen University)	
14:30-14:50	Pinaki Sengupta (Nanyang Technological University)	The 1/9 magnetisation plateau in the Kagome lattice antiferromagnet
14:50-15:10	Ji Chen (Peking University)	Neural network wavefunction for correlated topological states
15:10-15:30	Zhijie Fan (University of Science and Technology of China)	Universality Diagram of Phase Transitions in Long-range Statistical Systems
15:30-15:50	Zihong Liu (Fudan University)	Emergent relativistic symmetry from interacting fermions on the honeycomb bilayer
15:50-16:20	Tea Break	
Session 10	4 talks, Chair: Wenyuan Liu (Zhejiang University)	
16:20-16:40	Toshiya Hikihara (Gunma University)	Entanglement-Guided Structural Optimization of Tensor Networks
16:40-17:00	Qi Yang (University of Amsterdam)	QRCTM: scalable iPEPS simulation for frustrated quantum magnets
17:00-17:20	Nick Bultinck (Ghent University)	Quantum Monte Carlo fermion spectroscopy in a doped non-compact CP1 model
17:20-17:40	Didier Poilblanc (University of Toulouse)	Floquet chiral spin liquids
17:40-17:50	Closing remark by Xiao-Qun Wang (Zhejiang University)	
17:50-19:00	Dinner	
-	Departure	

Posters

No.	Name	Affiliation	Post Title
1	Xiansheng Cai	ITP CAS	Effective Field Theory of the Inhomogeneous Electron Gas
2	Yanmei Cai	School of Physics and Astronomy, and Key Laboratory of Multiscale Spin Physics (Ministry of Education), Beijing Normal University	Tuning superconducting pairing symmetry via a staggered potential in the doped honeycomb Hubbard model
3	Bin-Bin Chen	Beihang University	Probing Non-Fermi-Liquid Behaviour of Composite Fermi Liquid via Efficient Thermal Simulations
4	Feng Chen	The Chinese University of Hong Kong, Shenzhen	Topological chiral superconductivity in the triangular-lattice Hofstadter-Hubbard model
5	Michael Chen	Renmin university of China	A single-layer framework of variational tensor network states
6	Tao Chen	University of Science and Technology of China	Variational Monte Carlo (VMC) with row-update Projected Entangled-Pair States (PEPS) and its applications in quantum spin glasses
7	Yun Chen	Nanjing University	Multi-scale competition in the Majorana-Kondo system
8	Can Cui	Tsinghua University	Minimal loop currents in doped Mott insulators
9	Chengxiang Ding	Anhui University of Technology	Quench dynamics of an open quantum system
10	Yi-Ming Ding	Westlake University	Mixed-State Measurement-Induced Phase Transitions in Imaginary-Time Dynamics
11	Arthur Du	Northwest University	Dirac quantum criticality in the honeycomb-lattice Hubbard model: A finite-temperature quantum Monte Carlo study
12	Guijing Duan	Renmin University of China	Emergence of Kugel-Khomskii physics in quarter-filled bilayer correlated systems
13	Chaohui Fan	IOP-CAS	Disentangling Tensor Network States with Deep Neural Networks
14	Shuhao Fan	Beijing Normal University	Numerical Study of Stability of Clean Critical Points across Aperiodic, Topologically, and Uncorrelated Disorder

15	Zenghui Fan	Beijing Normal University	Emergent superconductivity and correlated phases dominated by strong interlayer exchange
16	Zhijie Fan	Hefei National Lab	Universality Diagram of Phase Transitions in Long-range Statistical Systems
17	Junqi Fang	Shanghai Jiao Tong University	Two-Point Stabilizer Rényi Entropy: a Computable Magic Proxy of Interacting Fermions
18	Jianxin Gao	Beihang University	Stochastic Symmetric Tensor Networks for Finite-Temperature Strongly Correlated Systems
19	Meng Gao	Lanzhou University	Violation of Luttingers theorem in a one-dimensional system of interacting fermions
20	Yuan Gao	Beihang University	Spin Seebeck Effect of Triangular Lattice Spin Supersolid
21	Gloria	Beijing University of Posts and Telecommunications	Staggered Potential Induced Coexistence of Charge Density Waves and Superconductivity
22	Yuntian Gu	Peking University	Solving the Hubbard model with Neural Quantum States
23	Chunhao Guo	Westlake University	Lee-Yang Zeros and Pseudocritical Drift in J-Q N ^{veel} -VBS Transitions
24	Wenan Guo	Beijing Normal University	Phase diagrams of S= 1/2 bilayer Models of SU(2) symmetric antiferromagnets
25	Tu Hong	Shanghai Jiao Tong University	Linear Canonical-Ensemble Quantum Monte Carlo: From Dilute Fermi Gas to Flat-Band Ferromagnetism
26	Pengcheng Hou	Hefei National Laboratory	First principles effective mass in the three-dimensional uniform electron gas
27	Sihan Hu	University of Science and Technology of China	How Large Language Models Learn to Reason: A Complex Network Perspective
28	Jiale Huang	Shanghai Jiao Tong University	Augmenting Density Matrix Renormalization Group with Matchgates and Clifford circuits
29	Xingmin Huo	Beihang University	Design of Altermagnetic Models from Spin Clusters
30	Zixuan Jia	Beijing Normal University	Interplay of magnetic and thermodynamic responses in the kagome-triangular system
31	Guiwen Jiang	School of Physical Science and Technology, Soochow University	Pressure induced redistribution of oxygen hole states in La ₄ Ni ₃ O ₁₀

32	Jian-Gang Kong	School of Physics, Renmin University of China	Phase diagram of the single-flavor Gross–Neveu–Wilson model from the Grassmann corner transfer matrix renormalization group
33	Han Li	Beijing Jiaotong University	Kitaev-derived Gapless Spin Liquid in the Frustrated Quantum Magnet Na ₂ Co ₂ TeO ₆
34	Qiaoyi Li	Institute of Theoretical Physics, CAS	Fluctuating Pair Density Wave in the Finite-temperature Phase Diagram of the t-t' Hubbard Model
35	Zhiyi Li	University of Science and Technology of China	Two-electron correlation in the metallic electron gas
36	Xuyang Liang	Sun Yat-sen University	Scaling of the disorder operator at (3+1)D O(3) quantum criticality
37	Ying Liang	Chongqing University	Frustrated Rydberg Atom Arrays Meet Cavity QED: Emergence of the Superradiant Clock Phase
38	Ying Liang	Beijing Normal University	Precompression engineering of metal-insulator transition and magnetism in designed breathing kagome systems
39	Shuao Liao	Chongqing University	Luttinger parameter in Rydberg array
40	Dong-Xu Liu	Westlake University	Entanglement Renyi Negativity across Finite Temperature Transition in O(3) Universality Class
41	Hongxing Liu	School of Physics and Astronomy, Beijing Normal University	Tuning superconductivity and charge-density-wave by next-nearest-neighbor hopping integral in honeycomb Holstein model
42	Jialin Liu	School of Physics, Chongqing University	Ground-state phase diagram of Rydberg atoms in a triangular-prism array
43	Lei-Yi-Nan Liu	Beihang University	Stabilizer Renyi Entropy for Translation-Invariant Matrix Product States
44	Lu Liu	Beijing Institute of Technology	Coplanar order induced by emergent frustration
45	Xingcan Liu	Harbin Institute of Technology	Thermodynamics and dynamics near a ferromagnetic quantum critical point
46	Xun Liu	Soochow University	Enhanced superconductivity via layer differentiation in the trilayer Hubbard model

47	Zenan Liu	Westlake University	Worldline deconfinement and emergent long-range interaction in entanglement Hamiltonian and entanglement spectrum
48	Zhixuan Liu	Fudan University	Improving Neural Network Variational Monte Carlo through Basis Transformation
49	Ziyu Liu	University of Science and Technology of China	Two-dimensional percolation model with long-range interaction
50	Longye Lu	Beijing Normal University	Detecting underlying symmetry-protected topological phases via strange correlators and edge engineering
51	Mingzhong Lu	University of Science and Technology of China	Slater-to-Mott Insulator Crossover in the Hubbard Model Revealed by Thermal Signatures
52	Enze Lv	Institute of Theoretical Physics	Quantum Supercritical Regime with Universal Magnetocaloric Scaling
53	Songtai Lv	East China Normal University	Giant bubbles of Fisher zeros in the quantum XY chain
54	Tianxing Ma	Beijing Normal University	Local Minimum of the Average Sign and Avoiding the Sign Problem
55	Xingyu Ma	Institute of Physics, Chinese Academy of Sciences	Low-temperature T^2 resistivity in the underdoped pseudogap phase versus T -linear resistivity in the overdoped strange-metal phase of cuprate superconductors
56	Binbin Mao	University of Health and Rehabilitation Sciences	Detecting the Emergent Continuous Symmetry of Criticality via a Subsystem's Entanglement Spectrum
57	Yiting Mao	Zhejiang University	Encoding complex-balanced thermalization in quantum circuits
58	Yu Ni	Yunnan Normal University	Interplay of Coulomb and Hund's Couplings in Orbital Polarization and Metal-Insulator Transitions
59	Zhi-Yao Ning	University of Tokyo	Spinon Confinement and String Breaking Near Deconfined Quantum Criticality
60	Yan Peng	School of Physical Science and Technology, Soochow University	Interplay between Hubbard interaction and charge transfer energy in the three-orbital Emery model: Implications for cuprates and nickelates

61	Jinghui Pi	The Chinese University of Hong Kong Shenzhen Research Institute	Imaginary-Stark skin effect
62	Xiangjian Qian	Shanghai Jiao Tong University	Disentangling Kitaev Quantum Spin Liquid
63	Bei Qiao	Institute of Physics, Chinese Academy of Sciences	Neural Control Variates for the Sign Problem in Resummation-Based Stochastic Series Expansion
64	Qiong Qin	Westlake University	Revealing altermagnetic Fermi surfaces with two Kondo impurities
65	Zhi-Yan Shao	Beijing Institute of Technology	Possible Liquid-Nitrogen-Temperature Superconductivity Driven by Perpendicular Electric Field in the Single-Bilayer Film of $\text{La}_3\text{Ni}_2\text{O}_7$ at Ambient Pressure
66	Changyu Shen	Beijing National Laboratory for Condensed Matter Physics & Institute of Physics	Universal Entanglement Growth along Imaginary Time in Quantum Critical Systems
67	Leilei Shi	Beijing Shangdafei Science & Technology Co. Ltd	Nonlocal Many-Body Wave Equation
68	Feng-Feng Song	The Institute for Solid State Physics, The University of Tokyo	Superfluid Dome in the Spatially Modulated Two-Dimensional XY Model
69	Yu-Feng Song	University of Science and Technology of China	Computation of thermal entropy in doped Fermi Hubbard model
70	Hang Su	Shanghai Jiao Tong University	Twisting operator criterion in 2-dimensional spin systems
71	Wenyu Su	Lanzhou University	Topological Resilience and the Emergence of a Skyrmion Glass in Bond-Disordered Chiral Magnets
72	Gaoyong Sun	Nanjing University of Aeronautics and Astronautics	1. Fidelity zeros and Lee-Yang theory of quantum phase transitions; 2. Non-Hermitian symmetry breaking and Lee-Yang theory for quantum XYZ and clock models
73	Yong-Yi Tang	Lanzhou University	Characterizing spin ordering via maximal row correlation in classical spin models

74	Wei-Lin Tu	Keio University	Low-temperature Gibbs state representation by matrix product states
75	Chuyi Tuo	Tsinghua University	Fractional quantum anomalous Hall and anyon density-wave halo in a minimal interacting lattice model of twisted bilayer MoTe ₂
76	Chunyang Wang	Northwest University	A Continuous-Time Quantum Monte Carlo algorithm for the Transverse-Field Ising Model
77	Fo-Hong Wang	Shanghai Jiao Tong University	Resolving the quantum criticality in Honeycomb Hubbard Model
78	Haoxin Wang	The Chinese University of Hong Kong	Pair-density-wave fluctuations in the lightly doped S_t - J_S model: density matrix renormalization group and finite-size project-entangled pair-state studies
79	Jingya Wang	Westlake University	Doped resonating-valence-bond states: Robustness of the spin-ice phases in three-dimensional Rydberg arrays
80	Junsen Wang	High Magnetic Field Laboratory, Hefei Institutes of Physical Sciences, Chinese Academy of Sciences	Spiral Spin Liquid on Shastry-Sutherland Lattice
81	Tao Wang	Institute of Physics, Chinese Academy of Sciences	Real-Time Quantum Dynamics in the Quantics Tensor Train Representation
82	Yan-Cheng Wang	Beihang University	Entanglement entropy and disorder operator at kagome deconfined quantum criticality
83	Yan-Xiao Wang	Lanzhou University	Ground-state phase diagram of the quarter-filled interacting Su-Schrieffer-Heeger chain
84	Yihan Wang	Beijing University of Posts and Telecommunications	Phase transitions in the self-dual generalization of the Ising model with anisotropic complex coupling
85	Zhe Wang	Westlake University	Complete finite-size scaling theory of Rényi thermal entropy for second, first and weak first order quantum phase transitions
86	Zhiyan Wang	Westlake University	Addressing off-diagonal measurements in Quantum Monte Carlo
87	Zihan Wang	Chongqing University	The phase transitions of two-dimensional $q=4$ and 5 Potts models by tensor network algorithms
88	Zhiling Wei	Nanjing University	Quantum criticality and emergent order in the spin-1 bilinear-biquadratic Kitaev chain

89	Hongkuan Xia	Hong Kong University of Science and Technology(guangzhou)	Decoding teleportation transition of long-range entangled state
90	Tianning Xiao	USTC	Fate of the Berezinskii-Kosterlitz-Thouless paired phase in coupled XY models
91	Zhuotao Xie	Northwest University	Interplay of Antiferromagnetism, Stripe Order, and Superconductivity in a Bilayer Hubbard Model
92	Zijian Xiong	Chongqing Normal University	Constraints from global symmetries of quantum ice on the planar pyrochlore lattice
93	Wei Xu	Chongqing University	Interplay of unidirectional quantum strings in Rydberg atom array
94	Wen-Tao Xu	Xi'an Jiaotong University	Tensor-Network Study of the Roughening Transition in $(2 + 1)$ D lattice gauge theories
95	Xia-Ze Xu	Tsinghua University	Efficient variational tensor-network approach to three-dimensional statistical systems
96	Jiawei Yan	Shanghai Institute of Microsystem and Information Technology, CAS	Many-body Josephson diode effect
97	Jian-Jian Yang	Sun Yat-sen University	Correlation effects in a simplified trilayer two-orbital Hubbard model at half filling
98	Shuo Yang	Tsinghua University	A New Framework for Quantum Phases in Open Systems: Steady State of Imaginary-Time Lindbladian Evolution
99	Siyi Yang	Westlake University	Exploring the limit of the lattice-Bisognano-Wichmann form describing the entanglement Hamiltonian: A quantum Monte Carlo study
100	Tao Yang	Department of Physics, Nanjing University	Probing quantum critical crossover via impurity renormalization group
101	Yun-Tong Yang	Lanzhou University	Ground state properties of the one-dimensional axial next-nearest-neighbor Ising model in a transverse field
102	Jinyuan Ye	Westlake university	Kinetic energy driven ferromagnetic insulator
103	Tian-Cheng Yi	Zhejiang Sci-Tech University	Topological and Mott phases driven by gain and loss in a correlated Chern insulator

104	Guangyu Yu	Kavli Institute for Theoretical Sciences, University of Chinese Academy of Sciences	Composite Boson Theory of Fractional Chern Insulators
105	Yin-Kai Yu	Institute of Physics, CAS	Sign-problem-free Bosonic Auxiliary Field Quantum Monte Carlo
106	Zhengyuan Yue	The Chinese University of Hong Kong	Competing Pair Density Wave Orders in the Square Lattice t-J Model
107	Chao Zhang	Anhui Normal University	The fate of a single impurity in the Bose-Hubbard model
108	Fan Zhang	University of Chinese Academy of Sciences	Phase Transition in Bilattice Transverse Field Ashkin-Teller model
109	Jin Zhang	Chongqing University	Quantum phases in the interacting generalized Su-Schrieffer-Heeger model
110	Qi Zhang	Institute of Physics, Chinese Academy of Sciences	Ab initio simulation of the first-order proton-ordering transition in water ice
111	Xu Zhang	Ghent University	Antiunitary symmetry for maximal correlation
112	Xue-Feng Zhang	Chongqing University	Spinon Singlet Pairing in $4a0 \times 4a0$ Plaquettes and $2a0$ Shift in Half-Filled Stripe LDOS
113	Zhaohui Zhi	The Hong Kong University of Science and Technology (GuangZhou)	Measurement induced phase transition and topological order
114	Hao Zhou	Institute of Modern Physics, Northwestern University	Visualizing Virtual Charge Fluctuations via Spin Correlations and Thermal Entropy Across the Hubbard-to-Heisenberg Crossover
115	Yanzhang Zhu	Westlake University	Bipartite Entanglement and Surface Criticality
116	Hongdao Zhuge	Beijing Normal University	Inducing metal-insulator transition via disorder in correlated kagome system
117	Chuan Chen	Lanzhou University	Anyon polarons as a window into

Sign-problem free quantum Monte Carlo simulation on strongly correlated fermion systems

Congjun Wu

Westlake University

Abstract: TBA

Introduction to Tensor-Network Methods

Frank Pollmann

Technical University of Munich

Abstract: TBA

Quantum Monte Carlo Simulation of Many-body physics with Rydberg systems: from supersolids to spin liquids

Lode Pollet

Ludwig-Maximilians-Universität München

Abstract: Rydberg tweezer arrays provide a versatile platform to explore quantum magnets. Different types of interactions, such as dipolar XY, van-der-Waals Ising ZZ, and spin-flip terms, can simultaneously exist. Furthermore, the Rydberg blockade mechanism can be used to prevent the excitation of another, nearby-situated Rydberg atom akin to the Gauss law in lattice gauge theory. In the talk I give an overview of the current state of the art and report on two different types of physics that can be realized with such platforms.

First, I comment on a recent experiment which exploited the blockade mechanism in order to observe the onset of a dynamically prepared, gapped Z₂ quantum spin liquid on the ruby lattice (Semgehini et al, Science 374, 1242 (2021)). The thermodynamic properties of such models remain inadequately addressed, yet knowledge thereof is indispensable if one wants to prepare large, robust, and long-lived quantum spin liquids. Using large scale quantum Monte Carlo simulations we find a renormalized classical spin liquid which better explains part of the experimental observations than a quantum spin liquid. I comment on the adiabatic approximation to the dynamical ramps for the electric degrees of freedom, and the magnitude of the observed string parity order parameters. Second, through combining the dipolar XY and Ising ZZ interactions, we predict the existence of a robust supersolid phase on the triangular lattice for 100s of particles based on explicitly calculated pair interactions for 87Rb and with a critical entropy in reach of current technology. Such a lattice supersolid is long-lived, found over a wide parameter range in an isotropic and flat two-dimensional geometry. It has true long-range order, even at finite temperature, thanks to the dipolar interactions, and would constitute a rare example of the defect-induced paradigm of supersolidity.

Bipartite Reweight-Annealing Framework for Quantum Monte Carlo: Efficient Computation of Entanglement Entropy and Negativity, Quantum Magic and Off-Diagonal Measurements

Zheng YAN

Westlake University

Abstract: By applying the idea of reweighting in Monte Carlo calculations, we can anneal the partition function to specific reference points, thereby solving for the partition function across the entire annealing parameter path. Furthermore, most quantum observables can be interpreted as ratios of generalized partition functions corresponding to two distinct manifolds of path integral. Leveraging the concept of reweight-annealing, we independently reweight-anneal each generalized partition function to a common reference point. If the ratio of the two partition functions at this reference point can be readily computed, the value of the physical observable across the entire parameter path is obtained. It is important to note that the annealing path is not limited to physically tunable parameters but can also include unconventional variables such as system size or imaginary time. This constitutes a universal framework for quantum Monte Carlo calculations, which we name the bipartite reweight-annealing algorithm. Using this algorithm, we have efficiently computed physical quantities—such as entanglement entropy, entanglement negativity, quantum magic resource, and off-diagonal operator measurements—that were historically challenging to extract via Monte Carlo methods.

Proving polynomial-time mixing of the Quantum Monte Carlo method

Jun Takahashi

The University of Tokyo

Abstract: The Quantum Monte Carlo (QMC) method has served as a powerful practical tool for computational condensed matter physics research. While it has been applied to systems with $\sim 10^5$ qubits interacting with Heisenberg interaction on a square lattice, and thus is empirically extremely efficient, rigorous proof has been lacking on the theoretical guarantee of convergence times.

Recently, it has been explicitly posed as an open question what the computational complexity of the antiferromagnetic (AFM) Heisenberg model ground state energy (also known as "quantum Max Cut" in the complexity community) calculation is for bipartite graphs. The question comes from a broader context of understanding the complexity of various physically motivated Hamiltonian families, and in a sense characterizing which ones are "more quantum". Although QMC is empirically efficient on bipartite AFM Heisenberg models, a theoretical proof will require a spectral gap type of argument for the Markov chain stochastic matrix, which is in general difficult, and is partially the reason why proofs have been lacking.

In this talk, I will explain our recent results on proving fast-mixing (polynomial upper bound on the convergence) of QMC algorithms for some sign-problem free (stoquastic) systems: AFM Heisenberg models on bipartite graphs with large imbalance, and any XY model that lacks the sign problem. I will explain the key ideas of the proof technique we use and discuss the physical implication that is implied by our results, such as the nonexistence of certain types of phase transitions.

Dissipation-induced bulk and boundary criticality in the Haldane chain

Zhenjiu Wang

Lanzhou University

Abstract: We study the quantum phase transition of a Haldane chain coupled to a dissipative Ohmic bath. This model serves as a low-energy description for a spin- $3/2$ chain ferromagnetically coupled to a two-dimensional metallic environment. Using large-scale quantum Monte Carlo simulations, we identify a dissipation-induced antiferromagnetic state in one dimension, characterized by Landau-damped Goldstone modes under strong dissipation. The bulk quantum phase transition from the Haldane state to this antiferromagnetic state is governed by a Wilson-Fisher fixed point with a dynamical exponent close to 2 . This critical behavior is closely related to the widely debated boundary and bulk criticality in $(2+1)$ -dimensional $O(N)$ systems. In particular, we discuss the boundary criticality at this transition, which arises from the coupling between topological edge modes and the bulk critical fluctuations.

Quantum criticality in open quantum systems from the purification perspective

Shuo Yang

Tsinghua University

Abstract: Open quantum systems host mixed-state phases that go beyond the symmetry-protected topological and spontaneous symmetry-breaking paradigms established for closed, pure-state systems. Developing a unified and physically transparent classification of such phases remains a central challenge. In this work, we introduce a purification-based framework that systematically characterizes all mixed-state phases in one-dimensional systems with $\mathbb{Z}_2^{\sigma} \times \mathbb{Z}_2^{\tau}$ symmetry. By introducing an ancillary \mathbb{Z}_2^{κ} chain and employing decorated domain-wall constructions, we derive eight purified fixed-point Hamiltonians labeled by topological indices $(\mu_{\sigma\tau}, \mu_{\tau\kappa}, \mu_{\kappa\sigma}) \in \{\pm 1\}^3$. Tracing out the ancilla recovers the full structure of mixed-state phases, including symmetric, strong-to-weak spontaneous symmetry breaking, average symmetry-protected topological phases, and their nontrivial combinations. Interpolations between the eight fixed points naturally define a three-dimensional phase diagram with a cube geometry. The edges correspond to elementary transitions associated with single topological indices, while the faces host intermediate phases arising from competing domain-wall decorations. Along the edges, we identify a class of critical behavior that connects distinct strong-to-weak symmetry-breaking patterns associated with distinct strong subgroups, highlighting a mechanism unique to mixed-state settings. Large-scale tensor-network simulations reveal a rich phase structure, including pyramid-shaped symmetry-breaking regions and a fully symmetry-broken phase at the cube center. Overall, our purification approach provides a geometrically transparent and physically complete classification of mixed-state phases, unified with a single $\mathbb{Z}_2^{\sigma} \times \mathbb{Z}_2^{\tau} \times \mathbb{Z}_2^{\kappa}$ model.

TNR approach to two-dimensional quantum systems at finite temperature

Atsushi Ueda

Ghent University

Abstract: Tensor network renormalization (TNR) has been a powerful tool for studying two-dimensional classical systems, where it gives direct access to universal information such as conformal field theory (CFT) data, beyond conventional analyses based on thermodynamic quantities. In this talk, I will discuss my recent extension of this approach to two-dimensional quantum systems at finite temperature. Since thermal phase transitions in these systems are still governed by two-dimensional criticality, TNR provides a natural framework to access their universal properties directly. I will present how this viewpoint leads to an efficient and accurate characterization of finite-temperature critical phenomena in quantum many-body systems.

Grassmann tensor network study on the single-flavor Gross-Neveu-Wilson model

Zhiyuan Xie

Renmin University of China

Abstract: In the framework of tensor networks, Grassmann algebra offers an elegant approach to interacting fermionic systems, yet it remains relatively less studied compared to other methods such as Z_2 -graded space and swap-gate formulations. In this talk, I introduce a simplified notation for existing Grassmann tensor networks and extend the corner transfer-matrix renormalization group (CTMRG), a widely used tensor network method for spin systems, to the Grassmann formalism. As an application, we apply the Grassmann CTMRG to the (1+1)-dimensional single-flavor Gross-Neveu-Wilson model. From the phase diagram in the (mass, fermion coupling)-plane, we verify the existence of three phases: a topological insulator phase, a trivial disordered phase, and a symmetry-breaking phase known as the Aoki phase. In particular, we find that the Aoki phase occupies a finite region enclosed by the other two phases, which differs from predictions based on the infinite-flavor limit and the continuum limit.

Variational Quantum Partial SVD with Orthogonality Correction: High-Precision Entanglement Spectra from Shallow Circuits

Hiroshi Ueda

Osaka University

Abstract: Extracting entanglement spectra on quantum devices is challenging due to the prohibitive cost of tomography and the need for deep circuits.

In this talk, we present a variational quantum framework that reformulates the Schmidt decomposition as a circuit optimization problem, leading to a partial singular value decomposition algorithm for directly accessing dominant entanglement structures.

By introducing an orthogonality-corrected deflation scheme, we achieve high-precision estimation of singular values even with shallow, noise-resilient circuits.

This approach offers a promising route toward scalable and hardware-efficient characterization of quantum many-body entanglement on near-term devices.

Thermal Tensor Network Approach to the Spin Seebeck Effect in a Triangular-Lattice Spin Supersolid

Wei Li

Institute of Theoretical Physics

Abstract: TBA

Isometric Tensor Networks

Frank Pollmann

Technical University of Munich

Abstract: TBA

Quantum-Inspired Computing and Beyond

Dario Poletti

Singapore University of Technology and Design

Abstract: We are going to present how tensor networks can be used to solve classical tasks, including a recent result from our group on anomaly detection. We will then discuss an extension of the tensor-network implementation of the quantum Fourier transform which is based on non-unitary gates and which can show significant speed-up when implementing the Laplace transform for signals that can be compressed efficiently into matrix product states.

Simulating fermionic fractional Chern insulators with infinite projected entangled-pair states

Juraj Hasik

University of Zurich

Abstract: Infinite projected entangled-pair states (iPEPS) provide a powerful variational framework for two-dimensional quantum matter and have been widely used to capture bosonic topological order, including chiral spin liquids. Here we extend this approach to *fermionic* topological order by variationally optimizing $U(1)$ -symmetric fermionic iPEPS for a fractional Chern insulator (FCI), with bond dimensions up to $D=9$. We find evidence for a critical bond dimension, above which the ansatz faithfully represents the FCI phase. The FCI state is characterized using bulk observables, including the equal-time single-particle Green's function and the pair-correlation function, as well as the momentum-resolved edge entanglement spectrum. To enable entanglement-spectrum calculations for large iPEPS unit cells, we introduce a compression scheme and show that the low-lying part of the spectrum is already well converged at relatively small cutoff dimensions.

Symmetry-enhanced pseudo-first-order transition from competing Dirac masses

Manuel Weber

Technische Universität Dresden

Abstract: Emergent symmetries and slow crossover phenomena are central topics in quantum criticality and prominently manifest in the pseudocritical scaling discussed in the context of deconfined criticality. Here we identify its conceptual counterpart: a symmetry-enhanced pseudo-first-order transition. It emerges from a one-dimensional realization of deconfined criticality between charge- and bond-ordered states driven by competing Holstein and Su-Schrieffer-Heeger electron-phonon couplings. In this setup, quantum fluctuations and thereby the nature of the transition can be tuned systematically via the phonon frequency. In the classical phonon limit, a low-energy Dirac theory predicts a direct first-order transition with emergent $U(1)$ symmetry. Exact quantum Monte Carlo simulations provide strong evidence for symmetry enhancement and even finite-size scaling on intermediate length scales. However, in the thermodynamic limit a narrow intermediate phase emerges in which both order parameters are finite, as chiral $U(1)$ symmetry is weakly broken on the lattice. Including quantum lattice fluctuations narrows the intermediate phase, gradually restores the $U(1)$ symmetry, and ultimately tunes the system to a deconfined quantum critical point.

Superconductivity and Charge Density Wave in the Holstein Model on the Penrose Lattice

Lu Liu

Beijing Institute of Technology

Abstract: The exotic quantum states emerging in the quasicrystal (QC) have attracted extensive interest because of various properties absent in the crystal. In this Letter, we systematically study the Holstein model at half filling on a prototypical structure of QC, namely rhombic Penrose lattice, aiming at investigating the superconductivity (SC) and other intertwined ordering arising from the interplay between quasiperiodicity and electron-phonon interaction. Through unbiased sign-problem-free determinant quantum Monte Carlo simulations, we reveal the salient features of the ground state phase diagram. Distinct from the results on bipartite periodic lattices at half filling, SC is dominant in a large parameter regime of the electron-phonon coupling (EPC) strength on the Penrose lattice. The strongest SC emerges in the intermediate EPC strength regime, where it coexists with the charge density wave. The charge density wave dominates the SC only in the sufficiently strong EPC regime. Our results also reveal pronounced pairing fluctuation above the transition temperature T_c of the SC. The strong pairing and its fluctuation originate from the cooperative effects of the QC structure without translational symmetry and the macroscopically degenerate confined states at the Fermi energy, which uniquely exist on the Penrose lattice. Our unbiased numerical results suggest that the Penrose lattice is a potential platform to realize strong SC pairing, providing a promising avenue to discover relatively high- T_c SC predominantly induced by the EPC.

The Su-Schrieffer-Heeger as a playground for correlated phases

Natanael C. Costa

Universidade Federal do Rio de Janeiro

Abstract: In this seminar, we discuss recent quantum Monte Carlo results for the Su-Schrieffer-Heeger (SSH) model and its extensions, with emphasis on how electron-phonon coupling and lattice geometry drive the emergence of unconventional quantum phases. We first revisit the SSH model as a paradigmatic setting for bond-coupled electrons interacting with lattice degrees of freedom. Then, we proceed to present results for the optical SSH model, where the use of optical phonons significantly reshapes the phase diagram and reveals additional phases. Next, we consider a modified version of the SSH model that includes a quadratic kinetic operator, and show that it provides a route to deconfined quantum criticality on the square lattice, with the critical behavior tunable by the electron-phonon interaction. Finally, we extend the analysis to frustrated lattices, where geometric frustration suppresses conventional ordering and gives rise to quantum-disordered phases with signatures consistent with a Z_2 spin liquid. These results highlight SSH-type models as an important platform for exploring correlated phases.

Quantum Monte Carlo studies of diverse strongly correlated Hamiltonians

Huaiming Guo

Beihang University

Abstract: Quantum Monte Carlo (QMC) provides an unbiased and large-scale numerical approach for studying strongly correlated quantum systems. In this report, I will present several applications of QMC to different strongly-correlated models. We show that in the kagome-lattice Hubbard model, superconductivity emerges upon doping, with a clear electron-hole asymmetry: hole doping favors chiral d-wave pairing, while electron doping stabilizes an s-wave state. For the honeycomb antiferromagnet under triaxial strain, QMC reveals strain-induced suppression of magnetic order and unconventional pseudo-Landau-level behavior beyond spin-wave theory. Finally, using a unitary mapping, we identify robust pair-density-wave superconductivity in σ_z -Hubbard and t-J-type Hamiltonians.

Quantum phase diagram of hole-doped Hubbard model on diagonal square lattice

Yifan Jiang

ShanghaiTech University

Abstract: We employ large-scale density-matrix renormalization group (DMRG) simulations to investigate the quantum phase diagram of hole-doped Hubbard model on square lattices. By implementing a diagonally oriented square lattice (rotated by $\pi/4$) and GPU-accelerated DMRG with up to 48000 states, we identify three distinct quantum phases across $\delta = 5\%$ to 15% doping: (i) A diagonal stripe phase with short-range uniform superconductivity (SC) at lower doping $\delta \lesssim 9\%$; (ii) An intermediate holon Wigner crystal (WC*) phase exhibiting bidirectional charge-density order and short-range SC with spatial oscillating correlations; (iii) An unprecedented infinite-length stripe (i-stripe) phase at $\delta \gtrsim 12\%$ hosting long stripes spanning the whole lattice. Remarkably, as doping increases, the short-range SC in WC* phase evolves into a 2D-like pair density wave (PDW) with divergent susceptibility in the i-stripe phase, constituting probably the first controlled numerical evidence of dominant PDW in the single-band square-lattice Hubbard model. The established 2D-like PDW and its interplay with WC* and charge stripes provide new perspectives on dynamical layer decoupling phenomena in cuprates and multifaceted relationships between charge, spin and SC orders in strongly correlated materials.

Classically simulatable quantum many-body states

Mingpu Qin

Shanghai Jiao Tong University

Abstract: I will discuss classically simulatable quantum many-body states from the perspectives of tensor network states, Clifford circuits, and Matchgate. With tensor network states we can efficiently handle low-entangled states. Stabilizer state which is constructed from Clifford circuits can be efficiently simulated according to the Gottesman-Knill theorem. The quantum state formed by Matchgate in the fermionic representation is the Gaussian state, which is also efficiently simulatable classically. I will show how to integrate these three ingredients to develop more powerful algorithms for the simulation of quantum many-body states.

Spinon Singlet: Microscopic Mechanism of d-Wave Pairing in a Partially-Filled Stripe

Shijie Hu

Beijing Computational Science Research Center

Abstract: TBA

Ab initio simulation of strongly correlated molecular systems using tensor network and neural network quantum states

Zhendong Li

Beijing Normal University

Abstract: In this talk, I will present our recent efforts on simulating strongly correlated molecular systems using tensor network and neural network quantum states.

First, I will introduce a randomized orbital optimization algorithm to find entanglement-minimized orbitals (EMOs) for Fermions using low bond dimension spin-adapted matrix product states. On one hand, this method leads to better approximate ground states with much lower energies at the same computational cost. On the other hand, the resulting EMOs can be used in quantum computation, which can significantly boost the success probability of quantum phase estimation.

Second, I will introduce a spin-adapted neural network backflow ansatz for simulating systems, which guarantees the correct treatment of spin symmetry and increased accuracy at the similar number of variational parameters.

Correlation tuned Fermi-arc topology in a Weyl ferromagnet

Zhiping Yin

Beijing Normal University

Abstract: Electrons on Fermi arcs, a hallmark of Weyl semimetals, exhibit chiral transport harboring chiral anomaly, negative magnetoresistance, and Majorana zero modes. While Fermi arcs were observed in exemplary Weyl semimetal TaAs and Co₃Sn₂S₂, the manipulation of Fermi arcs has been rarely explored. Here we take Co₃Sn₂S₂ as an example and demonstrate that tuning the electronic correlation strength is an effective way to control the topology and connectivity of Fermi arcs. After achieving a good agreement with experimentally measured band structure by employing combined density functional theory and dynamical mean field theory (DFT+DMFT) calculations, we show that the experimental charge dynamics are well reproduced by DFT+DMFT calculations but not DFT calculations. Electronic correlation renormalizes the bands around the Fermi level and modifies the energy and location of Weyl points, and the resulting Fermi arcs. In particular, on the Co-terminated surface, the Fermi arcs are formed by connecting Weyl points located in adjacent Brillouin zones in DFT+DMFT calculations and experiments, in strong contrast to the Fermi arcs connecting Weyl points within the same Brillouin zone in DFT calculations. We further show the evolution of Fermi arcs with correlation and reveal a topological change of the Fermi arcs on the Sn-terminated surface at stronger correlation strength. Our study sheds new light on experimental manipulation of Fermi arcs to improve the electronic properties of correlated Weyl semimetals.

Correlation-driven Heavy Weyl Fermion State in CeRu₄Sn₆

Yuanfeng Xu

Zhejiang University

Abstract: TBACeRu₄Sn₆ was proposed as a topological heavy-fermion system in our previous predictions, and it has attracted extensive attention in recent experiments. Using LDA + Gutzwiller calculations, we incorporated the strong correlations associated with Ce 4f electrons into an effective quasiparticle description. We found that the renormalized low-energy bands near the Fermi level host both type-I and type-II Weyl points. These results place CeRu₄Sn₆ in a new class of strongly correlated topological phases, in which Weyl topology coexists with heavy quasiparticle. Surface calculations further reveal an orientation-dependent observability of topological surface states. Long Fermi-arc states are expected on the (010) surface, whereas they are not clearly resolved on the (001) surface, consistent with the different projections of the bulk Weyl features onto the surface Brillouin zone. We also discuss the corresponding topological phase diagram as a function of correlation strength.

Possible spin triplet superconductivity due to altermagnetic spin fluctuations

Chao Cao

Zhejiang University

Abstract: TBA

Obstructed Mott insulator in layered Nb3I8

Gang Li

ShanghaiTech University

Abstract: Strong electronic correlations and covalent bonding are two fundamental pillars that drive insulating behavior in quantum materials, manifest in distinct states such as Mott insulators and obstructed atomic insulators (OAIs). While Mott insulators arise from Coulomb-induced localization and OAIs from bonding-induced Wannier center displacement, their convergence remains a rarely explored frontier. Here, we show that a real-space obstruction persists in the Mott limit, i.e. a Mott obstructed atomic insulator, in the layered material Nb₃I₈. With dynamical mean-field theory (DMFT) calculations, we show the Mott gap from both the bulk states and the obstructed surface state, confirming the synergy between crystalline symmetry and strong correlations. Our results establish MOAIs as a distinct correlated quantum phase and identify interacting OAIs as a platform for exploring correlation-driven boundary phenomena beyond conventional band topology.

Deep variational free energy for dense hydrogen calculations

Xinyang Dong

Institute of Physics, Chinese Academy of Sciences

Abstract: This talk presents a deep variational free-energy method for dense hydrogen systems and its application to two open problems: the phase behavior of hydrogen near 1200 K and the Hugoniot curve in the warm dense matter regime. By combining neural-network representations of proton distributions, electronic wave functions, and finite-temperature electronic occupations, this method provides a unified many-body framework for studying phase competition, entropy, and finite-temperature electronic effects in dense hydrogen.

Topological physics in quantum critical systems

Xuejia Yu

The Eastern Institute of Technology, Ningbo

Abstract: Topology forms a cornerstone in modern condensed matter and statistical physics, offering a new framework to classify the phases and phase transitions beyond the traditional Landau paradigm. However, it is widely believed that topological properties are destroyed when the bulk energy gap closes, making it highly nontrivial to consider topology in gapless quantum critical systems. To address these challenges, recent advancements have sought to generalize the notion of topology to systems without a bulk energy gap, including quantum critical points and critical phases collectively, referred to as gapless symmetry-protected topological states. Extending topology to gapless quantum critical systems challenges the traditional belief in condensed matter physics that topological edge states are typically tied to the presence of a bulk energy gap. Furthermore, it suggests that topology plays a crucial role in classifying quantum phase transitions even if they belong to the same universality class, fundamentally enriching the textbook understanding of phase transitions. Given its importance, here we give a pedagogical review of the current progress of topological physics in quantum critical systems. We introduce the topological properties of quantum critical points and generalize them to stable critical phases, both for noninteracting and interacting systems. Additionally, we discuss further generalizations and future directions, including higher dimensions, nonequilibrium phase transitions, and realizations in modern experiments.

Compact Representation, Compression, Continuation, and Spectra of Response Functions in Time and Frequency

Emanuel Gull

University of Michigan

Abstract: Response functions in quantum and classical systems possess well-known analytic structure that can be exploited to dramatic computational advantage. This talk presents a unified framework for compressing response function data, performing analytic continuation in the complex plane, extrapolating short-time information to long times, suppressing unphysical noise, and enabling fast evaluation in both time and frequency domains. The approach is illustrated through applications to Monte Carlo and semianalytical data.

Magnetotopological mechanics in Maxwell lattice frustrated Mott insulators

Gang Chen

Peking University

Abstract: Topological boundary modes, a hallmark of quantum topological phases, remarkably occur in classical mechanical systems through an interesting correspondence with the quantum case. Here, we explore the Maxwell lattice frustrated Mott insulators and argue that the combination of the intrinsic spin-lattice coupling and the spin exchanges could induce the topological mechanics with topological boundary floppy modes in the phonon spectra. This mechanism and phenomena are dubbed magnetic topological mechanics, or, magnetotopological mechanics in short. Focusing on a two-dimensional kagomé lattice spin model, we illustrate how strong spin-lattice coupling drives a spontaneous lattice distortion, resulting in the topological Maxwell lattice with the topological polarization and non-trivial phonon spectra. Moreover, the magnetic field, that directly changes the spin state, indirectly influences the lattice structure via the spin-lattice coupling, thereby providing a method to control the Maxwell lattice and the boundary modes. We expect this work to inspire interests in the Maxwell lattice Mott insulating materials and the coupling between lattices and electronic orders.

Preempting fermion sign problem: Unveiling quantum criticality through nonequilibrium dynamics in imaginary time

Zixiang Li

Institute of Physics, Chinese Academy of Sciences

Abstract: The notorious fermion sign problem, arising from fermion statistics, presents a fundamental obstacle to the numerical simulation of quantum many-body systems. Here, we introduce a framework that circumvents the sign problem in the studies of quantum criticality and its associated phases by leveraging imaginary-time nonequilibrium critical dynamics. We demonstrate that the critical properties can be accurately determined from the system's short-time relaxation, a regime where the sign problem remains manageable for quantum Monte Carlo simulations. After validating this approach on two benchmark fermionic models, we apply it to the sign-problematic Hubbard model hosting SU(3)-symmetric Dirac fermions. We present the first numerically exact characterization of its quantum phase diagram, revealing a continuous transition between a Dirac semimetal and a SU(3)-antiferromagnetic phase. This transition defines an unconventional Gross-Neveu universality class that fundamentally reshapes current understanding of Gross-Neveu criticality. Our work provides a powerful tool for investigating sign-problematic systems and quantum criticality.

Resolving Quantum Criticality in the Honeycomb Hubbard Model

Xiaoyan Xu

Shanghai Jiao Tong University

Abstract: Quantum phase transitions driven by electronic correlations are central to understanding the physics of graphene and related two-dimensional materials. A paradigmatic example is the semimetal-to-Mott-insulator transition on the honeycomb lattice, governed by the Gross-Neveu-Heisenberg universality class, yet consensus on its critical exponents has remained elusive for over a decade due to severe finite-size effects and the absence of rigorous conformal bootstrap benchmarks. Here we resolve this long-standing controversy by performing projector determinant quantum Monte Carlo simulations on lattices of unprecedented size, reaching 10,368 sites. By developing a novel projected submatrix update algorithm, we achieve a significant algorithmic speedup that enables us to access the thermodynamic limit with high precision. We observe that the fermion anomalous dimension and the correlation length exponent converge rapidly, while the boson anomalous dimension exhibits a systematic size dependence that we resolve via linear extrapolation. To validate our analysis, we perform parallel large-scale simulations of the spinless t - V model on the honeycomb lattice, which belongs to the Gross-Neveu-Ising class. Our results for the t - V model show agreement with conformal bootstrap predictions, thereby corroborating the robustness of our methodology. Our work provides state-of-the-art critical exponents for the honeycomb Hubbard model and establishes a systematic finite-size scaling workflow applicable to a broad class of strongly correlated quantum systems, paving the way for resolving other challenging fermionic quantum critical phenomena. Our results provide definitive theoretical benchmarks for the relativistic Mott transition recently observed in twisted double bilayer WSe₂.

Orbital-Selective Mott transition in a U(1) gauge model of the Kondo lattice: a Quantum Monte Carlo study

Gaopei Pan

Julius-Maximilians-Universität Würzburg

Abstract: We investigate a U(1) gauge theory formulation of the dimensional mismatch Kondo model describing a spin chain on a semi-metallic surface. Using sign-problem-free determinant quantum Monte Carlo simulations, we compute the single-particle spectra, optical conductivity, and dynamical spin structure factor of the composite fermions across a wide range of parameters.

Our results reveal a clear evolution from a Kondo-screened heavy-fermion regime to a Kondo-breakdown phase where the composite fermion spectral weight collapses. Most strikingly, the zero-frequency optical conductivity displays a sharp suppression at the breakdown point, accompanied by a redistribution of spectral weight, which cannot be explained by simple band-structure effects. Instead, the data support an interpretation in terms of an orbital-selective Mott transition, where the f-sector becomes localized while the conduction c electrons remain itinerant.

Together, these findings provide unbiased numerical evidence for a gauge-fluctuation-driven Kondo breakdown and demonstrate how composite-fermion and optical conductivity can diagnose orbital-selective Mott transition in strongly correlated metals.

**Auxiliary-field quantum Monte Carlo with variational auxiliary-field
quantum Monte Carlo trial wave functions**

Zhiyu Xiao

Institute of Physics, Chinese Academy of Sciences

Abstract: TBA

The $1/9$ magnetisation plateau in the Kagome lattice antiferromagnet

Pinaki Sengupta

Nanyang Technological University

Abstract: TBA

Neural network wavefunction for correlated topological states

Ji Chen

Peking University

Abstract: Real space neural network wavefunction framework combined with variational Monte Carlo provides a powerful approach for calculating the correlated topological quantum states. In this talk, I will discuss the computational frameworks and a series of developments to apply neural network wavefunction approaches to correlated topological systems, including fractional quantum Hall and fractional topological states in moire systems.

Universality Diagram of Phase Transitions in Long-range Statistical Systems

Zhijie Fan

University of Science and Technology of China

Abstract: The percolation, Ising, and $O(n)$ models constitute fundamental systems in statistical and condensed matter physics. For short-range-interacting cases, the nature of their phase transitions is well established by renormalization-group theory. However, the universality of the transitions in these models remains elusive when algebraically decaying long-range interactions $\sim 1/r^{d+\sigma}$ are introduced, where d is the dimensionality and σ is the decay exponent. Building upon insights from Levy flight, i.e., long-range simple random walk, we propose three universality diagrams in the (d, σ) plane for the percolation model, the $O(n)$ model, and the Fortuin-Kasteleyn Ising model, respectively. The conjectured universality diagrams are consistent with recent high-precision numerical studies and rigorous mathematical results, offering a unified perspective on critical phenomena in systems with long-range interactions.

Emergent relativistic symmetry from interacting fermions on the honeycomb bilayer

Zihong Liu

Fudan University

Abstract: We study the phase diagram of interacting spinless fermions on the honeycomb bilayer at charge neutrality using large-scale quantum Monte Carlo simulations. In the noninteracting limit, the low-energy spectrum features quadratically dispersing bands that touch at the corners of the hexagonal Brillouin zone. Weak to intermediate interactions induce a splitting of each of the quadratic band touching points into four Dirac points, located along high-symmetry directions of the reciprocal lattice. Strong interactions lead to the formation of a layer-polarized charge density wave, which spontaneously breaks the Z_2 layer inversion symmetry and opens an insulating gap in the spectrum. We show that the semimetal-to-insulator quantum phase transition as a function of interaction is continuous and characterized by emergent relativistic symmetry. Our results for the values of the correlation-length exponent ν , the order-parameter anomalous dimension η_ϕ , and the fermion anomalous dimension η_ψ agree with those of the theoretically predicted 2+1D Gross-Neveu-Ising universality class with eight two-component Dirac fermions within less than 5% deviation. We also determine the crossover scale as a function of interaction strength between the nonrelativistic semimetal state at high temperatures, characterized by dynamical critical exponent $z = 2$, and the Dirac semimetal state at intermediate temperatures, characterized by $z = 1$. Further reducing the temperature below the crossover scale at a fixed value of the interaction strength above the quantum critical point results in a classical ordering transition in the 2D Ising universality class.

Entanglement-Guided Structural Optimization of Tensor Networks

Toshiya Hikiyara

Gunma University

Abstract: The capability of tensor networks (TNs) to represent high-rank tensors, such as quantum many-body wave functions, depends strongly on the network structure. Consequently, considerable effort has been devoted to developing methods for optimizing the structure of TNs tailored to the target high-rank tensors. In this talk, I will discuss approaches to optimizing TN structures guided by the entanglement geometry of the target high-rank tensors. First, I will introduce the least-entanglement entropy (EE) principle, which minimizes EEs on the auxiliary bonds of a TN; This least-EE principle serves as the guiding principle for the TN structural optimization. I will then discuss algorithms of the structural optimization of TNs, including matrix product states, tree tensor networks, tensor product states or projected entangled pair states, and TNs of entanglement renormalization.

QRCTM: scalable iPEPS simulation for frustrated quantum magnets

Qi Yang

University of Amsterdam

Abstract: Replacing SVD with QR decomposition in the CTMRG (QRCTM) yields up to two orders of magnitude speedup on GPUs without sacrificing accuracy. Combined with automatic differentiation, this delivers state-of-the-art variational energies for the square-lattice J_1 - J_2 model within a single H100 hour. We generalize QRCTM to honeycomb lattices by exploiting the native C_{3v} site symmetry and apply it to the Kitaev-Heisenberg model, where algebraic dimer-dimer correlations and a clean finite- \times scaling collapse of the transfer matrix spectrum jointly confirm the gapless spin liquid. For higher-spin Kitaev models, we resolve the long-standing question of the ground-state nature, finding conventional symmetry-broken order rather than a spin liquid. These applications illustrate the power of QRCTM for iPEPS studies of frustrated two-dimensional magnets.

Quantum Monte Carlo fermion spectroscopy in a doped non-compact CP1 model

Nick Bultinck

Ghent University

Abstract: We have simulated a sign problem-free model of electrons coupled to a bosonic field whose physics is described by the non-compact CP1 theory, which has a deconfined U(1) gauge field. I will show results both for the dispersion relation of a single hole or electron, and for the low-energy electronic spectral weight at finite doping. I will also explain how these results agree with an effective field theory description obtained in a so-called rotating spin reference frame.

Floquet chiral spin liquids

Didier Poilblanc

University of Toulouse

Abstract: Chiral Spin Liquids (CSL) are quantum spin analogs of electronic Fractional Chern Insulators. Their realizations on ultracold-atom or Rydberg-atom platforms remain very challenging. In this talk I will consider periodically-driven quantum spin-1/2 system on the square lattice which can both (i) emulate a dynamical CSL (DCSL) (described at high-frequency by an effective static local chiral Hamiltonian) or (ii) implement, for (an infinite set) of lower fine-tuned frequencies, "Swap" models exhibiting anomalous CSL phases, in which one-way spin transport occurs at the edge although the bulk time-evolution operator over one period is trivial. I will show how to use the (recently proposed) average-energy spectrum concept on finite-size torus and cylinders to unfold the Floquet quasi-energy spectrum over the whole frequency range and obtain the geometrical Berry phases.

I will also show that, on a finite cluster, the DCSL can be represented faithfully by a two-dimensional time-periodic PEPS tensor network and, as in the static case, topological order is associated to a tensor gauge symmetry (Z_2 in that case). I will discuss possible extensions to the thermodynamic limit (iPEPS) and towards a description of the anomalous CSL.