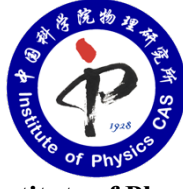




Northwest University



Institute of Physics
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Chongqing University

The 12th Workshop on Quantum Many-Body Computation

Conference Manual

Supported by Peng Huanwu Center for Fundamental Theory (Xi'an), NSFC
April 11-15, 2024, Xi'an, Shaaxi Province, China

Workshop Venue & Travel

Workshop venue

Xi'an Paradise Resort (西安曲江惠宾苑宾馆, 千人宴会厅 A 段)

Address

No. 388 South Section of Yanta South Road, Xi'an, Shaanxi Province, China (陕西省西安市雁塔区雁塔南路南段 388 号)

Local Travel Map to workshop venue

(1) Xi'an Xianyang International Airport (西安咸阳国际机场): ~44 km

By taxi: ~70 min & RMB 140

By subway: line 14 + line 4 to QuJiangChiXi Station (曲江池西站), ~ 40 min

By bus: Shuttle Bus between the airport and QuJiang, ~100 min

(2) Xi'an Railway Station (西安火车站): ~12 km

By taxi: ~40 min & RMB 30

By subway: line 4 to QuJiangChiXi Station (曲江池西站), ~ 40 min

By bus: Bus 500, ~50 min

(3) Xi'an North Railway Station (西安北站): ~22 km

By taxi: ~60 min & RMB 70

By subway: line 4 to QuJiangChiXi Station (曲江池西站), ~ 110 min

By bus: Bus 609, ~120 min



Table of Contents

Introduction to the Workshop	1
Information of QMBC2024	2
Invited Lecturers & Speakers	3
Program	5
Posters	9

Introduction to the workshop

Quantum many-body computation has emerged as a pivotal area of research within condensed matter physics. It incorporates diverse computational strategies to address the exponential wall challenge inherent in highly entangled many-body quantum systems. The field encompasses a large number of intriguing phenomena, such as high-temperature superconductivity and quantum magnetism. Recently, it has increasingly intersected with areas like ultracold atomic gas, machine learning, and quantum computation.

This workshop is designed to provide young researchers and graduate students with comprehensive tutorials on both foundational techniques and recent innovations in quantum many-body computation. It also aims to foster interaction within the community. QMBC-2024 will build on the substantial groundwork laid by previous workshops, with a focus on the latest developments in the field. The topics covered will include exact diagonalization, quantum Monte Carlo, density matrix renormalization group, tensor networks, machine learning, and more.

Previous workshops

2011: Chongqing University

2012: Lanzhou University

2013: Sun Yat-Sen University

2014: Hubei University

2015: Shanghai Jiao Tong University

2016: Beijing Computational Science Research Center

2017: University of Chinese Academy of Sciences

2018: Zhejiang University

2019: Renmin University of China

2020-2021: Skipped due to COVID19

2022: IOP/Shanghai Jiao Tong University

2023: MinJiang University

Information of QMBC2024

Schedule

2024.04.11	Onsite registration (13:00~21:00)
2024.04.12	Tutorial Lectures
2024.04.13~14	Research talks
2024.04.15	Departure

Workshop Venue

Xi'an Paradise Resort (西安曲江惠宾苑宾馆, 千人宴会厅 A 段)
No. 388 South Section of Yanta South Road, Xi'an, Shaanxi Province, China (陕西省西安市雁塔区雁塔南路南段 388 号)

Accommodation

Xi'an Paradise Resort (西安曲江惠宾苑宾馆)
Orange Hotel around Grand Tang Mall (桔子酒店-大唐不夜城店)

Advisory Committee

Hai-Qing Lin (Zhejiang University)
Zhong-Yi Lu (Renmin University of China)
Gang Su (University of Chinese Academy of Sciences)
Xiaoqun Wang (Zhejiang University)
Tao Xiang (Institute of Physics, Chinese Academy of Sciences)

Coordinators

Yuan-Yao He (Northwest University)
Zi-Xiang Li (Institute of Physics, Chinese Academy of Sciences)
Shuo Yang (Tsinghua University)
Xue-Feng Zhang (Chongqing University)

Local Organizers

Wen-Li Yang (Northwest University)
Junjie Liu (Northwest University)
Yuan-Yao He (Northwest University)
Xiao-Hui Wang (Northwest University)
Junhui Zheng (Northwest University)

Workshop Secretary

Kun Zhang (Northwest University) Email: kunzhang@nwu.edu.cn
Xiucong Xue (Northwest University)

Invited Lecturers (listed in alphabetical order)

Shiwei Zhang, CCQ, Flatiron Institute

Dao-Xin Yao, Sun Yat-Sen University

Invited Speakers (listed in alphabetical order)

Fakher Assaad, Universität Würzburg

Zi Cai, Shanghai Jiao Tong University

Bin-Bin Chen, The University of Hong Kong

Chen Cheng, Lanzhou University

Kun Chen, Institute of Theoretical Physics, Chinese Academy of Sciences

Youjin Deng, University of Science and Technology of China

Sebastian Eggert, University of Kaiserslautern-Landau

Wenan Guo, Beijing Normal University

Jiangping Hu, Institute of Physics, Chinese Academy of Sciences

Shi-Jie Hu, Beijing Computational Science Research Center

Yi-Fan Jiang, ShanghaiTech University

Wei Li, Institute of Theoretical Physics, Chinese Academy of Sciences

Haijun Liao, Institute of Physics, Chinese Academy of Sciences

Yang Liu, Institute of Physics, Chinese Academy of Sciences

Zhao Liu, Zhejiang University

Yi Lu, Nanjing University

Ian McCulloch, National Tsing Hua University

Zi Yang Meng, The University of Hong Kong

Mingpu Qin, Shanghai Jiao Tong University

Shi-Ju Ran, Capital Normal University

Weiluo Ren, ByteDance Research

Anders W. Sandvik, Boston University

Xiao Yan Xu, Shanghai Jiao Tong University

Rong Yu, Renmin University of China

Yuan Wan, Institute of Physics, Chinese Academy of Sciences

Yilin Wang, University of Science and Technology of China

Zizhu Wang, University of Electronic Science and Technology of China

Zheng-Yu Weng, Tsinghua University

Guang-Ming Zhang, Tsinghua University

Jin Zhang, Chongqing University

Junhui Zheng, Northwest University

Program

Thursday, 11 April 2024

Registration at the hotel lobby, 13:00-20:00

Friday, 12 April 2024

Registration at the hotel lobby, 08:30-21:00

Tutorial Lectures (each with a 20min break), Chair: Hui Shao, Zheng Yan

10:00-11:50	Shiwei Zhang (CCQ, Flatiron Institute)	Auxiliary-field Quantum Monte Carlo algorithms for correlated fermion systems
11:50-14:00	Lunch	
14:00-15:50	Dao-Xin Yao (Sun Yat-Sen University)	Multi-orbital models and superconducting properties of $\text{La}_3\text{Ni}_2\text{O}_7$ and $\text{La}_4\text{Ni}_3\text{O}_{10}$
18:00	Dinner	

Saturday, 13 April 2024

Registration at the hotel lobby, 08:00-08:50

08:45-09:00 Welcome and opening by **Tao Xiang & Wen-Li Yang**

Session 1 3 talks, Chair: Gang Su

09:00-09:20	Fakher Assaad (Universität Würzburg)	Auxiliary-field quantum Monte Carlo for frustrated spin systems
09:20-09:40	Anders W. Sandvik (Boston University)	SO(5) Multicriticality at the transition from antiferromagnet to valence-bond solid in two dimensions
09:40-10:00	Zheng-Yu Weng (Tsinghua University)	Mott Physics at Doping: Elephant in the Living Room
10:00-10:10	Photo	
10:10-10:30	Tea Break	

Session 2 4 talks, Chair: Hong-Gang Luo

10:30-10:50	Sebastian Eggert (University of Kaiserslautern-Landau)	Time-Periodic driving near resonance: Simulations and calculations of many-body states
10:50-11:10	Wenan Guo (Beijing Normal University)	Improved scaling of the entanglement entropy and its applications
11:10-11:30	Rong Yu (Renmin University of China)	Field-controlled multicritical behavior and emergent universality in fully frustrated quantum magnets

11:30-11:50	Wei Li (Institute of Theoretical Physics, CAS)	Dual Magnon-Roton Excitations of Spin Supersolid on a Cobalt-based Triangular Lattice
11:50-13:30	Lunch	
13:30-14:30	Poster Session	
Session 3	4 talks, Chair: Tian-Xing Ma	
14:30-14:50	Jiangping Hu (Institute of Physics, CAS)	Loop Current States in Correlated Electron Systems
14:50-15:10	Mingpu Qin (Shanghai Jiao Tong University)	DMRG results of the minimum model for La ₃ Ni ₂ O ₇ and the charge order in infinite-layer nickelate
15:10-15:30	Yilin Wang (University of Science and Technology of China)	Heavy-fermions and lattice dynamics in frustrated Hund's metal with portions of incipient flat-bands
15:30-15:50	Yi-Fan Jiang (ShanghaiTech University)	Pair density wave superconductivity: a microscopic model in two dimensions
15:50-16:10	Tea Break	
Session 4	4 talks, Chair: Lei Wang	
16:10-16:30	Zi Cai (Shanghai Jiao Tong University)	Quantum slush state in Rydberg atom arrays
16:30-16:50	Yuan Wan (Institute of Physics, CAS)	Time-domain interferometry of electron weak localization through terahertz nonlinear optical response
16:50-17:10	Jin Zhang (Chongqing University)	Probing quantum floating phases in Rydberg atom arrays
17:10-17:30	Zhao Liu (Zhejiang University)	Fractional Chern Insulators in Twisted Double Bilayer Graphene
18:00	Dinner	

Sunday, 14 April 2024

Session 5	4 talks, Chair: Xiaoqun Wang	
09:00-09:20	Youjin Deng (University of Science and Technology of China)	Crossover and Néel phase transition in the three-dimensional fermionic Hubbard model: A Monte Carlo and cold-atom experiment study
09:20-09:40	Zi Yang Meng (The University of Hong Kong)	Entanglement entropy at quantum and deconfined quantum critical points
09:40-10:00	Xiao Yan Xu (Shanghai Jiao Tong University)	Entanglement of Many-Body Mixed States

10:00-10:20	Kun Chen (Institute of Theoretical Physics, CAS)	Numerical Effective Field Theory Approach to the Many-Electron Problem: From Fundamental Theory to Precise Predictions
10:20-10:40	Tea Break	
Session 6	4 talks, Chair: Zhong-Yi Lu	
10:40-11:00	Ian McCulloch (National Tsing Hua University)	Scale invariance and type-B Goldstone modes
11:00-11:20	Guang-Ming Zhang (Tsinghua University)	Tensor network approach to two-dimensional fully frustrated XY spin models
11:20-11:40	Haijun Liao (Institute of Physics, CAS)	Spin excitation spectra of the spin-1/2 Kagome Heisenberg antiferromagnets
11:40-12:00	Yi Lu (Nanjing University)	Dynamical correlation functions from complex time evolution
12:00-13:30	Lunch	
13:30-14:30	Poster Session	
Session 7	4 talks, Chair: Shuo Yang	
14:30-14:50	Zizhu Wang (University of Electronic Science and Technology of China)	Variational optimization for quantum tasks using generative models
14:50-15:10	Weiluo Ren (ByteDance Research)	Recent Advances in Neural Network-Based Quantum Monte Carlo
15:10-15:30	Chen Cheng (Lanzhou University)	Probing phase transitions with correlations in configuration space: a Monte Carlo study on lattice models
15:30-15:50	Shi-Ju Ran (Capital Normal University)	Persistent ballistic entanglement spreading with optimal control in quantum spin chains
15:50-16:10	Tea Break	
Session 8	4 talks, Chair: Yinghai Wu	
16:10-16:30	Shi-Jie Hu (Beijing Computational Science Research Center)	Density-matrix renormalization group algorithm for non-Hermitian systems
16:30-16:50	Junhui Zheng (Northwest University)	Anomalous Floquet topological insulators under optical speckle potential
16:50-17:10	Bin-Bin Chen (The University of Hong Kong)	Phases of (2+1)D SO(5) non-linear sigma model with topological term on sphere: multicritical point and disorder phase
17:10-17:30	Yang Liu (Institute of Physics, CAS)	Fractional quantum hall effect, geometrical excitation, and matrix product state representation

17:30-17:50	Closing remark by Hai-Qing Lin
18:00	Dinner

Monday, 15 April 2024
Departure

Posters

No.	Name	Affiliation	Poster Title
1	Xinyang Dong	AI for Science Institute, Beijing	Equivariant neural network for Green's functions of molecules and materials
2	Chao Zhang	Anhui Normal University	Light polarons with electron-phonon coupling
3	Yuan Gao	Beihang University	Magnetic Excitations of Spin Supersolid on a Triangular Lattice
4	Yan-Cheng Wang	Beihang University	Scaling of disorder operator with tilted region at quantum criticality
5	Wen Chen	Beijing Computational Science Research Center	Multifractality and prethermalization in the quasiperiodically kicked Aubry-André-Harper model
6	Jilu He	Beijing Computational Science Research Center	Ground state phase diagram of spin-3/2 J1-J2-Dz chain
7	Song Cheng	Beijing Institute of Mathematical Sciences and Applications	Simulating Noisy Variational Quantum Algorithms: A Polynomial Approach
8	Kun Hu	Beijing Normal University	Wetting transition in the transverse-field spin-1/2 XY model with boundary fields
9	Liuyun Dao	Beijing Normal University	Anomalous Rotor Excitations on Site-Diluted Square Lattice Spin-1/2 Heisenberg Antiferromagnets
10	Fan Zhang	Beijing Normal University	Phase diagram of a square lattice model of XY Spins with direction-dependent interactions
11	Qiaoni Chen	Beijing Normal University	Ferromagnetism and band structure of ReRh_6Ge_4
12	Sibei Li	Beijing Normal University	TBD
13	Tianxing Ma	Beijing Normal University	Charge Stripe Manipulation of Superconducting Pairing Symmetry Transition
14	Zijian Xiong	Chongqing Normal University	1-form symmetry and the selection rule of the plaquette valence bond solid phase
15	Yang Liu	East China Normal University	Fisher Zeros on the Disorder Side of the Transverse Field Ising Chain
16	Songtai Lv	East China Normal University	Many-body computing on Field Programmable Gate Arrays
17	Yan Liu	Fudan University	TBD
18	Shuai Yang	Fudan University	Chiral spin textures driven by emergent spin-orbit interaction: a numerical study
19	Xing-Can Liu	Harbin Institute of Technology	Possible spin-triplet pairing instability near type-II van Hove singularities
20	Na Li	Hebei Normal University	Scaling behaviors of long-range entanglement distribution in spin chains with exponentially and power-law decaying interactions

21	Di Han	Hebei Normal University	Fractional Chern insulator with Rydberg-dressed neutral atoms
22	Yan-Kui Bai	Hebei Normal University	Diagnosing Quantum Phases Using Long-Range Two-site Quantum Resource Behaviors
23	Pengcheng Hou	Hefei National Laboratory	Many-Electron Field Theory Integrated with AI Tech Stack
24	Zhijie Fan	Heifei National Laboratory	Two-dimensional XY Ferromagnet Induced by Long-range Interaction
25	Ying-Hai Wu	Huazhong University of Science and Technology	Quantum Phase Transitions of Fractional Quantum Hall States
26	Zihang Li	Institute of Physics, Chinese Academy of Sciences	Deep generative model based variational free energy approach to warm dense hydrogen
27	Xingyu Zhang	Institute of Physics, Chinese Academy of Sciences	2D excitation in formation by MPS method on helix
28	Qi Zhang	Institute of Physics, Chinese Academy of Sciences	Solving vibrational Hamiltonians with neural canonical transformation
29	Kang Wang	Institute of Physics, Chinese Academy of Sciences	Fractionalization Signatures in the Dynamics of Quantum Spin Liquids
30	Pengfei Li	Institute of Physics, Chinese Academy of Sciences	Correlated BCS wave function approach to unconventional superconductors
31	Wei-Wei Yang	Institute of Physics, Chinese Academy of Sciences	Shubnikov-deHaas effect in the Falicov-Kimball model: strong correlation meets quantum oscillation
32	Shan Dong	Institute of Semiconductors, Chinese Academy of Science	First-principles studies on two-dimensional excitonic insulators
33	Qiaoyi Li	Institute of Theoretical Physics, Chinese Academy of Sciences	A High Performance Julia Package for Matrix Product State Computations
34	Ning Xi	Institute of Theoretical Physics, Chinese Academy of Sciences	Thermal Tensor Network Approach for the NMR Spin Lattice Relaxation in Quantum Magnets
35	Enze Lv	Institute of Theoretical Physics, Chinese Academy of Sciences	TBD
36	Yun-Tong Yang	Lanzhou University	Identifying the ground-state phases by spin-patterns in the Shastry-Sutherland model
37	Yongfeng Yang	Lanzhou University	Edge states induced by quasi-periodic structures in 1D t-J model
38	Wenyu Su	Lanzhou University	The correlation between Monte Carlo sampling configurations was used to study phase transitions
39	Leiqiang Li	Minjiang University	Orbital-designed flat-band model and realization of superconductivity in three-dimensional materials
40	Zhiling Wei	Nanjing University	TBD
41	Zhengzhong Du	Nanjing University	TBD
42	Gaoyong Sun	Nanjing University of Aeronautics and Astronautics	Unconventional many-body phase transitions in a non-Hermitian Ising chain

43	Jesse Osborne	University of Queensland (Australia)	Quantum Simulators for Lattice Gauge Theories
44	Fang-mei Yang	Northwest Normal University	Resonator-qutrits quantum battery
45	Hanghai Chen	NYU Shanghai and New York University	An electronic origin of charge order in infinite-layer nickelates
46	Yubing Qian	Peking University	Electric polarization and interatomic force from neural network-based quantum Monte Carlo
47	Weizhong Fu	Peking University	Diffusion Monte Carlo and Variance Extrapolation Method with Neural Network Ansatz
48	Tonghuan Jiang	Peking University	Accurate many-body wavefunctions from full configuration interaction quantum Monte Carlo
49	Lei Geng	Peking University	Anomalous photo induced band renormalization in Ta ₂ NiSe ₅ studied by non-equilibrium Green's function
50	Tengzhou Zhang	Shanghai Jiao Tong University	Quantum slush state in Rydberg atom arrays
51	Zheng-Xin Guo	Shanghai Jiao Tong University	Far-from-equilibrium universal critical behavior of quantum geometry
52	Fanjie Sun	Shanghai Jiao Tong University	Delayed updates in Determinantal Quantum Monte Carlo method
53	Jiale Huang	Shanghai Jiao Tong University	On the Magnetization of the 120°-order of the Spin-1/2 Triangular Lattice Heisenberg Model: a DMRG revisit
54	Fo-Hong Wang	Shanghai Jiao Tong University	Entanglement Renyi Negativity of Interacting Fermions from Quantum Monte Carlo Simulations
55	Xiangjian Qian	Shanghai Jiao Tong University	Parent Hamiltonian for Fully-augmented Matrix Product States
56	Yang Shen	Shanghai Jiao Tong University	The ground state of electron-doped t-t'-J model on cylinders
57	Gui-Xin Liu	ShanghaiTech University	Quantum phase diagram of the extended Spin-3/2 Kitaev Heisenberg model on three- and four-leg cylinders
58	Zhi Xu	ShanghaiTech University	Superconductivity enhancement and particle-hole asymmetry interplay with electron attraction in doped Hubbard model
59	Chong Hou	Southeast University	Bulk-boundary correspondences for skin and edge modes in a general two-band non-Hermitian system
60	Pan Zhou	Southern University of Science and Technology	TBD
61	Yu-Feng Song	Southern University of Science and Technology	Auxiliary-Field Quantum Monte Carlo study of three-dimensional Hubbard model
62	Xinwei Jia	Sun Yat-Sen University	Phase diagram and critical behavior of Hubbard model on the square-hexagon-octagon lattice

63	Li-Mei Chen	Sun Yat-Sen University	Chiral spin liquid in a Z_3 Kitaev model
64	Meng-Yuan Li	Sun Yat-Sen University	A hierarchy of long-range entanglement patterns
65	Zhi Zeng	Sun Yat-Sen University	Finite-time Scaling beyond the Kibble-Zurek Prerequisite: Driven Critical Dynamics in Strongly Interacting Dirac Systems
66	Yin-Kai Yu	Sun Yat-Sen University	Preempting fermion sign problem: Unveiling quantum criticality through non-equilibrium dynamics
67	Wei-Yang Chen	Sun Yat-Sen University	TBD
68	Zenan Liu	Sun Yat-Sen University	TBD
69	Changzhi Zhao	Taiyuan University of Technology	First-order type of vortex lattice melting in the double-layered ice by the loop Monte Carlo method
70	Wanzhou Zhang	Taiyuan University of Technology	Emergent topological ordered phase for the Ising-XY Model revealed by cluster-updating Monte-Carlo method
71	Hongyu Lu	The University of Hong Kong	Nontrivial Interplay Between Electronic Liquid Crystal Order and Topological Order in Correlated Topological Flat Bands
72	Jiarui Zhao	The University of Hong Kong	Quantum Entanglement Entropy as a probe of novel quantum phase and phase transitions
73	YuanDa Liao	The University of Hong Kong	The Incremental Method for Calculating Entanglement Entropy
74	Xiu-cai Jiang	TongJi University	Site-selective insulating phase in a twisted bilayer Hubbard model
75	Hua-Ying Liu	TongJi University	The two-stage Kondo breakdown induced by electron doping in correlated multiband system
76	Miaomiao Li	TongJi University	FeSe 材料的第一性原理及模型计算
77	Liya Qiao	TongJi University	TBD
78	Zheng-Tao Xu	Tsinghua University	Global phase diagram of doped quantum spin liquid on the Kagome lattice
79	Pei-Yuan Zhao	Tsinghua University	Chebyshev pseudosite matrix product state approach for cluster perturbation theory
80	Shuo Yang	Tsinghua University	Locally Purified Density Operators: Simulation and Tomography
81	Yuchen Guo	Tsinghua University	Locally purified density operators for noisy quantum circuits
82	Xuan Zou	Tsinghua University	TBD
83	Junsen Wang	University of Chinese Academy of Sciences	Crossovers and Universal Scaling in Quantum Supercriticality
84	Yunlong Zang	University of Chinese Academy of Sciences	Detecting Quantum Anomalies in Open Systems
85	Dai-Wei Qu	University of Chinese Academy of Sciences	D-wave Superconductivity, Pseudogap, and the Phase Diagram of t-J Model at Finite Temperature
86	Xing-Zhou Qu	University of Chinese Academy of Sciences	Orbital selective and pressure dependent superconductivity in bilayer $\text{La}_3\text{Ni}_2\text{O}_7$

87	Han Li	University of Chinese Academy of Sciences	Magnetocaloric Effect of Topological Excitations in Kitaev Magnets
88	Hao Zhang	University of Science and Technology of China	Competing phases and suppression of superconductivity in a hole-doped Hubbard model on the honeycomb lattice
89	Zhiyi Li	University of Science and Technology of China	TBD
90	Zhe Wang	Westlake University	Emerging edge long-range interactions at the (2+1)D-dimensional O(3) critical point
91	Xiang Li	Wuhan University	Trion states of attractive SU(3) ultracold fermions in optical lattices
92	Tian-Cheng Yi	Zhejiang Sci-Tech University	Two-dimensional polarized superfluids under the prism of the fermion sign problem
93	Ang Yang	Zhejiang University	Observation of many-body dynamical localization
94	Junlin Wang	Zhejiang University	The classical correspond of quantum many-body scar based on TDVP
95	Jun Zhan	Institute of Physics, Chinese Academy of Sciences	Emergence of Loop Current Order in the spinless Kagome Hubbard model

Special thanks to



Acknowledgement

