XIN LU

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Permanent Address: China

RESEARCH INTERESTS

My research activities focus on the strongly correlated systems and novel states in various quantum many-body systems. The specific research interests include but are not limited to unconventional superconductivity, doped Mott insulators, quantum spin liquids, and quantum magnetism, and cold atom quantum simulations, etc. I prefer in combining large scale numerical simulations with analytical approaches to understand the exotic quantum phases and phase transitions in condensed-matter physics.

EMPLOYMENT

The University of Hong Kong — Hong Kong, China
Postdoctoral Fellow in Department of Physics — 2026.10-2028.10

- Collaborator: Prof. Zi-Yang Meng
- Research Area: Computational and theoretical quantum many-body physics

EDUCATION

Beihang University — Beijing, China
Ph.D. in School of Physics — 2020.09-2026.07

- Supervisor: Prof. Shou-Shu Gong, Prof. Huaiming Guo
- Research Area: DMRG, High-Tc superconductivity, Quantum magnetism
- Dissertation: Density matrix renormalization group study of unconventional superconducting states in doped Mott insulators

National University of Singapore — Singapore
Joint Ph.D. in Department of Physics — 2024.10-2025.10

- Supervisor: Prof. Liujun Zou
- Research Area: Exact diagonalization, Quantum spin liquid, Deconfined quantum criticality

Shaanxi Normal University — Xi'an, China
B.S. in School of Physics and Information Technology — 2016.08-2020.06

- GPA 4.82/5.00
- Supervisor: Prof. Wei Jin
- Research Area: First-principles (*ab initio*) calculations in strongly correlated nanosystems
- Dissertation: First-principles study of laser-induced ultrafast spin dynamics in transition metal-borophene clusters

PUBLICATIONS

[12] **Xin Lu**, Andreas Raikos, Menghan Song, Zezong Li, Lankun Han, Shiliang Li, Sylvain Capponi, Zi Yang Meng, Chengkang Zhou, "*Unraveling the Kagome Antiferromagnetic 3J Model and Its Materials: An Integrated Approach*", arXiv:2609.11745.

[11] **Xin Lu**, Jia-Xin Zhang, Lukas Homeier, Shou-Shu Gong, D. N. Sheng, Zheng-Yu Weng, "*Competing and Intertwined Orders in Boson-Doped Mott Antiferromagnets*", **Phys. Rev. Lett.** 136, 096506 (2026).

[10] Yuan Yang, **Xin Lu**, Yuan Wan, Wei-Qiang Chen, Shou-Shu Gong, "*Evolution from intralayer to interlayer superconductivity in a bilayer t-J-J⊥ ladder*", **Phys. Rev. B** 114, 225122 (2026).

[9] Anjali Jain*, Lee Yong Heng*, **Xin Lu***, Pranab Kumar Das, Muhammad Avicenna Naradipa, Caozheng Diao, Xiaojiang Yu, Liujun Zou, Ramanathan Mahendiran, Andrivo Rusydi, "*Quantum Spin Phases in a Non-Magnetic Doped Perovskite Manganite*", **under review in ACS Nano**.

[8] **Xin Lu**, Huaiming Guo, Wei-Qiang Chen, D. N. Sheng, Shou-Shu Gong, "*Tuning competition between charge order and superconductivity in the square-lattice t-t'-J model*", **Phys. Rev. B** 111, 035139 (2025).

[7] **Xin Lu**, Feng Chen, Wei Zhu, D. N. Sheng, Shou-Shu Gong, "*Emergent Superconductivity and Competing Charge Orders in the Hole-Doped Square-Lattice t-J Model*", **Phys. Rev. Lett.** 132, 066002 (2024).

[6] **Xin Lu**, Jia-Xin Zhang, Shou-Shu Gong, D. N. Sheng, Zheng-Yu Weng, "*Sign structure of the t-t'-J model and its physical consequences*", **Phys. Rev. B** 110, 165127 (2024).

[5] **Xin Lu**, Dai-Wei Qu, Yang Qi, Wei Li, Shou-Shu Gong, "*Ground-state phase diagram of the extended two-leg t-J model*", **Phys. Rev. B** 107, 125114 (2023).

[4] **Xin Lu**, Meng-Lin Xie, Jing Liu, Wei Jin, Chun Li, Georgios Lefkidis, Wolfgang Hübner, "*First-principles study of ultrafast spin dynamics in Fe_mB_{20} (m=1, 2) clusters*", **Acta Phys. Sin.** 70, 127505 (2021) (**Editors' Suggestion**).

[3] Pengpeng Wang, Mingyang Qiu, **Xin Lu**, Wei Jin, Chun Li, Georgios Lefkidis, Wolfgang Hübner, "*First-principles study of spin properties and laser-induced ultrafast spin dynamics in transition-metal oxide clusters $TM_3O_3^{0/+}$ $(TM = Fe, Co, and\ Ni)$*", **Phys. Rev. B** 101, 104414 (2020).

[2] **Xin Lu**, Hua Zheng, *"Investigation on the radial wave function and energy level of hydrogen atom by the variational method"*, **College Physics** 38, 62-65 (2019) (Teaching Research).

[1] **Xin Lu**, Gangqiang Zhu, Rongxin Zhang, Shiping Li, Longkai Pan, Junli Nie, Fei Rao, *"I-doped Bi_2WO_6 microflowers enhanced visible light photocatalytic activity for organic pollution degradation and NO removal"*, **J. Mater Sci. Mater Electron.** 30, 17787 (2019).

INVITED TALKS / CONFERENCES / VISITS

- **Visiting Scholar at School of Physical Sciences, Great Bay University, Dongguan** — *June-July, 2026*
- **The 3rd Workshop on Quantum Computation meets Quantum Many-Body Computation at IOP, Beijing** — *June, 2026*
- **IASTU Summer Forum on Frontiers of Quantum Matter at THU, Beijing** — *June, 2026*
- **The 14th Workshop on Quantum Many-Body Computation, Beijing** — *April, 2026*
- **The 1st Quantum Intelligence Workshop at IOP, Beijing** — *December, 2025*
- **Tensor Network States: Algorithms and Applications 2024, Hong Kong** — *December, 2024*
- **The 6th International Symposium on Quantum Physics and Quantum Information Science, Beijing** — *October, 2024*
- **Summer School on Condensed Matter Physics 2024 at SJTU, Shanghai** — *July, 2024*
- **Quantum Magnetism and Many-Body Computation Training Class, Beijing** — *June, 2024*
- **The 1st Workshop on Quantum Computation meets Quantum Many-Body Computation at THU, Beijing** — *June, 2024*
- **Flat Bands and high-order Van Hove singularities at Center for Theoretical Physics of Complex Systems, Institute for Basic Science, Daejeon, South Korea** — *May-June, 2024*
- **The 12th Workshop on Quantum Many-Body Computation, Xi'an** — *April, 2024*
- **The International Conference on Magnetism and Superconductivity in Topological Matter at IOP, Beijing** — *November, 2023*
- **The 21th National Conference on Condensed Matter Theory and Statistical Physics, Jinan** — *October, 2023*
- **Department of Physics, Fuzhou University**
  (invited talk) "Hole binding, emergent superconductivity and competing charge orders in hole-doped square-lattice t-J model" — *October, 2023*
- **Asia-Pacific Workshop on Strongly Correlated Systems at IOP, Beijing** — *September, 2023*
- **Tensor Network States: Algorithms and Applications 2023, Shanghai** — *August, 2023*
- **2023 Seminar on Quantum Many-Body Computing Methods, Fuzhou** — *August, 2023*
- **IASTU Summer Forum on Frontiers of Quantum Matter at THU, Beijing** — *June, 2023*
- **The 11th Workshop on Quantum Many-Body Computation, Fuzhou** — *April, 2023*
- **Institute of Theoretical Physics, Chinese Academy of Sciences**
  (invited talk) "Ground-state phase diagram of the two-leg t-J ladder" — *November, 2022*
- **2022 Chinese Physical Society Fall Meeting at SUSTC, Shenzhen** — *November, 2022*

- **Peng Huanwu Collaborative Center for Research and Education Seminar on "Correlation and Topology in Quantum Materials" at BUAA, Beijing** *October, 2022*
- **The 10th Workshop on Quantum Many-Body Computation, Liyang** *August, 2022*
- **BUAA, NKU, TJU, UCAS Four Universities Joint Graduate Academic Forum** *December, 2021*
- **International Workshop on Tensor networks in Many-Body and Lattice Field at SJTU, Shanghai** *July, 2021*
- **2021 State Key Laboratory of Low-Dimensional Quantum Physics Summer School at THU, Beijing** *July, 2021*
- **2019 Annual Conference of Shaanxi Provincial Physical Society, Xi'an** *December, 2019*

GRANT RECORDS

- **Doctoral Student Program of the Young S&T Talents Cultivation Project, China Association for Science and Technology (CAST)** *Principal Investigator, 2025-2026*
- **China National University Student Innovation Program** *Principal Investigator, 2018-2019*
  "Study on the synthesis and photocatalytic performance of Bi_2WO_6 nano-semiconductor photocatalysts"

MAJOR HONORS & AWARDS

National Scholarship of China—Ph.D.	2024
National Scholarship of China—Undergraduate	2019
Baosteel Outstanding Student Award—Undergraduate (only 3 students)	2020
Student of the Year in 2020, the highest honor of SNNU (only 10 students)	2020
Outstanding Doctoral Dissertation Award of Beijing Municipality	2026
Outstanding Graduate of Beijing Municipality	2026
Outstanding Graduate Student in Beihang University	2026
"Tianmin Shuren" Scholarship in Beihang University	2025
The First Prize of Scholarship in Beihang University	2025
Outstanding Graduate Student in Beihang University	2025
The First Prize of Scholarship in Beihang University	2024
Outstanding Graduate Student in Beihang University	2024
Outstanding Teaching Assistant in Beihang University	2023
The Second Prize of Scholarship in Beihang University	2023
The First Prize of Scholarship in Beihang University	2022
Outstanding Graduate Student in Beihang University	2022
The First Prize of Scholarship in Beihang University	2021
The First Prize of Scholarship in Beihang University	2020
Graduate Freshman Scholarship in Beihang University	2020
Outstanding Bachelor's Degree Thesis Award in Shaanxi Normal University	2020
Outstanding Student in Shaanxi Normal University	2019
The First Prize of Scholarship in Shaanxi Normal University	2019
The First Prize of Scholarship in Shaanxi Normal University	2018
The First Prize of the 10th National Mathematics Competition for College Students	2018
The First Prize of the 3rd Undergraduate Basic Physics Experiment Contest, SNNU	2018
The Second Prize in National University students Mathematical Contest in Modeling	2018
The Excellence Award of the 1st China Undergraduate Physics Tournament, SNNU	2018
The Second Prize of Scholarship in Shaanxi Normal University	2017