Xicheng Wang

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Education

Tsinghua University *Sep. 2022 – Jun. 2026 (expected)*
B.S. in Fundamental Science of Mathematics & Physics, Zhili College
Overall GPA: 4.0/4.0, **Major Course GPA:** 4.00/4.00 (**rank:** 1/70) **GRE sub physics:** 990/990

Cornell University *Aug. 2024 – Dec. 2024*
Exchange student in Physics, The College of Arts & Science
Overall GPA: 4.0/4.3

Publications

1. **Xicheng Wang** and Erich J. Mueller, "*Engineering Resonating Kagome Dimer Coverings in Rydberg Atom Arrays.*" arXiv:2506.21255 (Accepted) (2025)
2. **Xicheng Wang**, Yi-Zhuang You, Da-Chuan Lu, "*Non-onsite Symmetries from Non-standard Algebras.*" in preparation (2026)

Relevant Courses

• **Selected Undergraduate Courses:** Quantum Mechanics(A^+), Statistical Physics(A), Electrodynamics(A) , Analytical Mechanics(A), Big Data in Experimental Physics I&II(A) , Feynman Lecture on Physics I,II & III(A) ...
• **Graduate-Level Courses:** Special Topics of Field Theories in Condensed Matter Physics(A^+) , Quantum Field Theory II , Cold Atom Physics , Topics in Field Theory and Condensed Matter , Solid-state Physics I(A^+) , Computational Physics , Quantum Information Processing(A^-) ...
• **Self-directed Study:** Group Theory, Category Theory in Physics, Conformal Field Theory, Quantum and Topology, Quantum Many-Body Computation Methods ...
○ **Courses without assigned letter grades:** either currently ongoing or graded on a pass/fail basis

Research Experience

Quantum Phases and Phase Transitions under Non-onsite Generalized Symmetries *May.2025 - Present*
Supervised by Prof. Yi-Zhuang You and Dr.Da-Chuan Lu University of California, San Diego

- We formulated a framework to extract possibly non-semisimple algebraic structures from local fusion data of symmetry MPOs. MPOs that satisfy certain fusion conditions correspond to intrinsically self-consistent semisimple algebraic structure, whereas those that fail to do so require additional consistency constraints and give rise to non-semisimple structures.
- We discussed the relation between non-onsiteness and non-semisimplicity, and demonstrated their mutual restrictions.
- We analyzed *intrinsically non-onsite symmetries*, which cannot be unitarily connected to onsite realizations without adding ancillae. Such symmetries correspond to non-standard algebraic structures, though the converse does not always hold. We demonstrated that the algebraic structure is not invariant under unitary transformations.
- We argue that intrinsically non-onsite symmetries can give rise to unconventional infrared behaviors. We investigated a trivial-to-SSB phase transition governed by the non-onsite $\mathbb{Z}_2$ symmetry, and numerically confirmed that it is described by a *compact-boson* CFT, in contrast to the Ising CFT in the onsite case.
- A manuscript is under preparation.

Preparing Topologically ordered Quantum States in Rydberg Atom Platforms *Aug.2024 - Oct.2025*
Supervised by Prof. Erich Mueller Cornell University

- We proposed a method to compare *inhomogeneous quasi-adiabatic sweeps* with uniform quenches. This analysis provides a microscopic perspective that goes beyond the inhomogeneous Kibble–Zurek mechanism.

- We derived analytic expressions for the excitation density in 1D spin chains featuring SSB or SPT phases. Uniform sweeps follow Kibble-Zurek scaling, while the inhomogeneous protocol can be described by an effective local Hamiltonian. This comparison reveals a clear scaling advantage of the inhomogeneous protocol. [Unpublished Work]
- We designed a series of local quantum gates that can be readily implemented on Rydberg atom platforms. By applying these gates sequentially, one can prepare the Rokhsar–Kivelson state within a time scaling as the square root of the system size. We also address the issue of initializing the dimer covering and embedding the state into a toric geometry, which differs significantly from the operations performed in the bulk.
- Our protocol represents a novel *sequential quantum circuit*(SQC) scheme. Compared to previous dynamical quasi-adiabatic protocols, this approach offers a better scaling and enhanced robustness. We mapped existing SQC approaches for 2D topological orders to our system, and analyzed how such analogs pose greater experimental challenges.
- We studied the relation between the minimal number of local degrees of freedom required for sequential generation and the structure of the MPS in one dimension. The conclusion is that this requirement is determined by the structure of the transfer matrix spectrum.
- This project culminated in a paper.

Other Research Trainings *2024,2025*

Supervised by Prof. Guangming Zhang and Dong E.Liu Respectively Tsinghua University

- Studied tensor-network methods and strongly correlated physics in Prof. Zhang's group.
- Studied topics including quantum error-corrections and measurement-based state preparation in Prof. Liu's group.

Honors & Awards

- ⋆ Spark Research Talents Fellowship, Tsinghua University (top 50/3500 in the cohort) 2025
- ⋆ Chi-Sun Yeh Scholarship, Fellowship of the Tsinghua Xuetang Talents Program 2022-2025
- ⋆ Chia-Hsien Teng Scholarship, Tsinghua University (one of Tsinghua University's highest honors) 2025
- ⋆ National Scholarship, The Ministry of Education of China (top 0.2% nationwide) 2024
- ⋆ Outstanding Student Leader, Tsinghua University (top 1% in the cohort) 2024
- ⋆ Tsinghua-Guangyao Grand Scholarship for Comprehensive Excellence, Tsinghua University (highest honor in Guangyao Scholarship series) 2023

Skills

- ◇ **Programming:** Python, Julia, Mathematica, C, C++, LaTeX, ...
- ◇ **Computation Methods:** ED, DMRG, TEBD, VUMPS; Proficient in Tenpy & ITensor packages; Monte Carlo.
- ◇ **Machine Learning:** Familiar with basic methods in PyTorch
- ◇ **Language:** Chinese(native); English (proficient, TOEFL 104 [R29/L27/S23/W25])

Leadership & Activities

- ◇ Organizer of Chi-Sun Yeh Physics Seminar, Tsinghua University 2025
- ◇ Chairman, Department of Academics and Learning, Zhili College, Tsinghua University 2024
- ◇ Class President , Zhili College, Tsinghua University 2024
- ◇ Member, Quantum Computation Association, Cornell University 2024
- ◇ Fellow , Science and Technology Association , Zhili College , Tsinghua University 2024
- ◇ Visiting Student, CERN *Aug*.2023