Yuan Xue

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EDUCATION

- **University of Texas at Austin** — Austin, Texas, US
  PhD candidate in physics; Advisors: Matteo Ippoliti & Eslam Khalaf — *Sep. 2022 - present*
- **University of California, Santa Barbara** — Santa Barbara, California, US
  Exchange student — *Sep. 2021 - Jun. 2022*
- **Huazhong University of Science and Technology** — Wuhan, Hubei, China
  Bachelor in Physics — *Sep. 2018 - Jun. 2022*

ON-GOING RESEARCH EXPERIENCE

- **Spin polaron in higher Chern bands** — Jan. 2023 - present
  collaborated with Eslam Khalaf
  - Analyze the higher Chern bands in graphene multilayers and decomposition of general higher Chern bands.
  - Identify the form factor of higher Chern bands.
  - Conduct exact diagonalization the projected interaction Hamiltonian in the spin polaron basis.
  - Determine the number of polaron bound states in the bands with different Chern numbers.
  - Investigate the counting by occupation configurations.

- **Boundary theories of the fracton model** — Apr. 2023 - present
  collaborated with Matteo Ippoliti, Zhu-Xi Luo
  - Analyze the (001) boundaries of Checkerboard: equivalence to two copies of Ising plaquette models.
  - Systematically categorize all the choices of (001) boundary stabilizers.
  - Numerically calculate the ground state degeneracy.
  - Interpret the ground state degeneracy in terms of condensations.
  - Investigate scenarios with open boundaries in all directions.
  - Examine additional boundary geometries: (111) and (110).
  - Develop a commutative-algebraic method to calculate the ground state degeneracy of boundary fracton models.

- **Entanglement renormalization of type-II fracton: $\mathbb{Z}_N$ Laplacian code** — May. 2023 - present
  collaborated with Zhu-Xi Luo, Pranay Gorantla, Ho Tat Lam, and Shu-Heng Shao
  - Determine the course-graining factor in general $\mathbb{Z}_N$ stabilizer codes analytically.
  - Discover a bifurcation in the $\mathbb{Z}_3$ Laplacian code on the square lattice, identifying a new B code associated with the Laplacian code.
  - Analyze the ground state degeneracy of the B code, both analytically and numerically.
  - Investigate the excitations of the B code.
  - Investigate the Laplacian code on Kagome lattice, triangular lattice, and honeycomb lattice.

RESEARCH SKILLS

- **Mathematics**:
  Commutative algebra; Graph theory.

- **Computation**:
  Exact diagonalization (ED) in Mathematica; Python

PUBLICATIONS & PREPRINTS

All my publications and preprints can be found on my Google Scholar

[1] Su-Qi Zhang, Jian-Song Hong, **Yuan Xue**, Xun-Jiang Luo, Li-Wei Yu, Xiong-Jun Liu, & Xin Liu, *Deterministic topological quantum gates for Majorana qubits without ancillary modes*, arXiv:2305.18190 (2023)

CONTRIBUTED TALKS AND POSTERS

[1] *Exotic gapped boundaries of fracton phases in the Checkerboard model.* **APS March meeting**, Minneapolis, US, March, 2024.

[2] *Spin polarons in higher Chern bands* (poster). **MRSEC Annual Meeting + Industry Day at The University of Texas at Austin**, Austin, US, February, 2024

[3] *Spin polarons in higher Chern bands* (poster). **Princeton Summer School on Condensed Matter Physics: Fractionalization, criticality and unconventional quantum materials**, Princeton, US, July, 2023

Schools & Workshops Attended

[1] Princeton Summer School on Condensed Matter Physics: Fractionalization, criticality and unconventional quantum materials, Princeton, NJ, 2023

Teaching experiences & Mentorship

[1] PHY 362K: Quantum physics II: atoms/molecules, Fall 2024, UT Austin.

[2] Directed Reading Program in Physics, Fall 2023, UT Austin.

[3] PHY 105N: Introductory electricity, magnetism, and optics laboratory, Spring 2023, UT Austin.

[4] PHY 105N: Introductory electricity, magnetism, and optics laboratory, Fall 2022, UT Austin.

Honors and Awards

- Scholarship for Scientific and Technological Innovation in 2021, *Huazhong University of Science and Technology*

- Scholarship for Academic Progress in 2020, *Huazhong University of Science and Technology*

- Scholarship for Scientific and Technological Innovation in 2020, *Huazhong University of Science and Technology*