YIZHOU MA

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EDUCATION

Fudan University September 2020 - Present
Bachelor of Science in Physics

- Cumulative GPA: 3.7/4.0 (top 10%); Major GPA: 3.75/4.0
- Advanced Courses: Quantum Field Theory, Quantum Computation and Quantum Information, Group Theory, General Relativity
- Self-Taught Courses: Abstract Algebra, Topology, Algebraic Topology
- TOEFL: 111
- GRE: 334+4.0

RESEARCH INTERESTS

- **Topological Phases** - Classification of topological orders, SPT and SET; interesting phenomena including anyon condensation, gauging, bulk-boundary corrrespondence, etc.
- **Quantum Information** - Quantify entanglement in topological phases and use entanglement to characterize topological phases in turn.
- **Quantum Computation** - Topological quantum computation; quantum algorithms.

PROJECTS AND RESEARCH EXPERIENCE

Systematic Identification of Topological Orders and Phase Transitions in Kitaev Honeycomb
September 2023 - Present
Supervised by Yidun Wan

- Use variational optimization to construct a ground-state iPEPS of the B phase with external magnetic field.
- Trying to extract modular data and identify the chiral Ising universal class from the iPEPS.
- Trying to understand the phase transition from toric code to chiral Ising.

Measurement Induced Phase Transition on Boundaries July 2023 - September 2023
Supervised by Xiao Chen

- Use techniques in the stabilizer formalism to efficiently compute boundary states after measurements in the bulk.
- Investigate the periodic behavior when perfoming uniform Pauli measurements in the bulk.
- Investigate the maximally entangled boundary states when performing random Pauli measurements in the bulk.

Leakage in Topological Quantum Computation by Fibonacci Anyons September 2021 - June 2022
Supervised by Yidun Wan

- Searched for leakage-free entangling two-qubit topological quantum gates up to length 20 by Julia and verified that no such gate exists.
- Conjectured that two-qubit gates are either leaking or non-entangling.
- Tried to generalize an algebraic number theoretic approach in literature to obtain the analytical form of two-qubit gates.
- Tried a Lie algebraic approach to prove my conjecture.
- Proposed a new design of qubits to reduce the number of anyons, thus reducing the dimensions of non-computational spaces and mitigating the leakage problem.

Simulating 2D Edwards-Anderson Spin Glass Models by Tensor Networks June 2022
Final Project of Statistical Mechanics I

- Implemented tensor network renormalization (TNR) to simulate binomial and Gaussian Edwards-Anderson models with sizes up to 64×64 by Python. We found that there are no first-order phase transitions in finite temperature.

- Parallelized the program by numba to significantly improve its performance. We also tried to utilize GPUs by CUDA, but finally realized that GPUs can hardly boost SVD for large numbers of low-dimensional matrices, which is required by TNR.

SKILLS

Computer Skills	Julialang, Python, C++, Latex, Linux
Numerical Skills	iPEPS, TRG
Languages	Chinese(*Native*), English(*Fluent*)

WORKSHOPS AND SEMINARS

Workshop on Category Theory and Topological Order
March 2023, Shenzhen International Quantum Academy

- Learned the philosophy of category theory and its relation to topological phases.

- Attended seminars on frontiers of topological phases and had discussions with professors and students from different institutes, including THU, PKU, SUSTech, HKU, cUHK, Perimeter Institute, etc.

HONORS AND AWARDS

Final Bronze Award, S.T. Yau College Student Math Contest 2023

- Ranked 7th in mathematical physics among participants from all over China.

Huawei Scholarship 2021

- Awarded to top5 students of the Physics Department in Fudan University.

Honored Student of Physics Department 2021 and 2022

- Qualified by good performance in challenging honor courses.