RUIHAO LI

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PROFILE

Physics PhD candidate with research experience in topological quantum materials and quantum computing. Proficient in scientific programming tools such as Python, Julia, Mathematica, etc. Familiar with quantum development frameworks including Qiskit, PennyLane, and Braket. A Qiskit Advocate.

EXPERIENCE

Qiskit Advocate Mentorship Program Mentee   Sept 2022 - Present
Qiskit - IBM Quantum   *Remote*

- Project I: Contributed to Qiskit-QEC, an open-source framework for quantum error correction. Implemented key features for the XP stabilizer formalism, including the XP operator algebra, modular arithmetics, and the Howell matrix transform, under the guidance of Dr. Drew Vandeth (IBM Research). Showcased in Qiskit Demoday (Feb 9, 2023).
- Project II: Ongoing research project focusing on simulating classical phase transitions on IBM quantum computers, under the guidance of Dr. Sona Najafi (IBM Quantum).

QOSF Mentorship Program Mentee   Apr 2022 - Jun 2023
Quantum Open Source Foundation   *Remote*

- Conducted literature review of the quantum approximate optimization algorithm (QAOA), culminating in a comprehensive review paper that analyzes the latest advancements and challenges in the field (arXiv:2306.09198).
- Developed a codebase based on *Qiskit* for benchmarking notable QAOA variants and extensions on IBMQ devices, providing insights into the practical use of QAOA in future research and real-world applications.

Quantum Algorithms Research Intern   May 2022 - Aug 2022
Agnostiq   *Toronto, Canada*

- Conducted a quantum machine learning project on developing non-trivial variational quantum algorithms for anomaly/novelty detection. Developed codes based on *PennyLane* and *PyTorch* for numerical experiments of the project.
- Produced three tutorials on machine learning topics (hybrid computation, autoencoders, and quantum kernel training) for Covalent, a workflow orchestration tool that the company is actively developing.

EDUCATION

Ph.D. in Physics, *Case Western Reserve University*, USA   Expected 2023
Theoretical Condensed Matter Physics (Advisor: Shulei Zhang)
Thesis: Novel spin and charge transport in topological semimetals

B.Sc. Honours (Advanced), *The University of Sydney*, Australia   Mar 2013 - Nov 2016
First Class Honours in Theoretical Particle Physics (Advisor: Michael A. Schmidt)
Thesis: Quantum Corrections in Left-Right Symmetric Seesaw Mechanisms

UCEAP exchange program, *University of California San Diego*, USA   Sept 2014 - Mar 2015

RESEARCH PUBLICATIONS

My current research encompasses two areas: 1. novel transport phenomena in topological semimetals; 2. quantum computing, mainly on digital simulations of spin systems and quantum optimization with a focus on NISQ-friendly algorithms. I have also worked on dark matter and neutrinos physics in new gauge theories beyond the Standard Model of particle physics.

A complete list of publications can be found on my Google Scholar profile.

TECHNICAL SKILLS

Languages	Python, Julia, Mathematica, LaTeX, JavaScript, CSS, Bash
Toolkits	NumPy, SciPy, Qiskit, PennyLane, Braket, Yao.jl, PyTorch, TensorFlow, Scikit-learn, Git, Slurm