

# RUIHAO LI

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## PROFILE

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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. I am a Qiskit Advocate recognized by IBM.

## EDUCATION

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**Ph.D. in Physics**, *Case Western Reserve University*, USA Expected 2023  
Theoretical Condensed Matter Physics (Advisor: Shulei Zhang)

**B.Sc. Honours (Advanced)**, *The University of Sydney*, Australia Mar 2013 - Nov 2016  
First Class Honours in Theoretical Particle Physics (Advisor: Michael A. Schmidt)

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

## EXPERIENCE

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

- Conducted extensive literature review of the quantum approximate optimization algorithm (QAOA) under supervision of Kostas Blekos (University of Patras, Greece).
- Developed codebase based on *Qiskit* for benchmarking different QAOA variants (recursive-QAOA, warm-start-QAOA, QAOA+, etc.) on IBM quantum computers.
- Writing a review paper that aims to provide current status of and guidance for the QAOA (to appear on arXiv soon).

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

- Contributed to [Qiskit-QEC](#), an open-source framework for quantum error correction, by implementing the XP stabilizer formalism under the supervision of Drew Vandeth and Grace Harper (IBM).
- Implemented XP operator algebra, modular arithmetics on  $\mathbb{Z}/n\mathbb{Z}$  and functionality related to the Howell matrix transformation. Developed unittests for the codes.

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

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

## RESEARCH PUBLICATIONS

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My current research encompasses two areas: 1. novel transport phenomena in topological semimetals; 2. quantum simulation of condensed matter systems. I have also worked on dark matter and neutrinos models in new gauge theories beyond the Standard Model. Publications can be found on my [Google Scholar](#) profile.

## TECHNICAL SKILLS

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**Languages** Python, Julia, Mathematica, MATLAB, JavaScript, CSS, LaTeX, Bash  
**Toolkits** NumPy, SciPy, Qiskit, PennyLane, Braket, PyTorch, TensorFlow, Scikit-learn, Covalent, Git, Slurm

## LEADERSHIP

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**Qiskit Fall Fest 2022 Organizer**, *CWRU* Oct 2022

- Co-organized [Qiskit Fall Fest 2022](#) at CWRU, where we hosted a week of quantum computing workshop series and a hackathon for students to take part in. Delivered a lecture on [\(Qiskit\) quantum machine learning](#).

**Condensed Matter Journal Club Organizer**, *CWRU* Jan 2022 - Apr 2022

- Co-organized the [condensed matter journal club](#) in Department of Physics, which brought in students from different research groups to present and discuss recent research progress in condensed matter physics.