

Jack Ceroni

jackceroni@gmail.com

(905)-220-2032

<https://lucaman99.github.io>

Last Updated: July 13th, 2023

Education

*September 2020—
Present*

Degree: Bachelor of Science in Pure Mathematics

Where: University of Toronto, Pure Math Specialist Program

- Cumulative GPA: 4.0/4.0

Employment

*May 2023—
Present*

Position: Visiting Research Student

Where: Massachusetts Institute of Technology

- Working in Isaac Chuang's research group in the Research Laboratory of Electronics.
- Collaborating with Zane M. Rossi on research in fault-tolerant quantum algorithms.

*September 2022—
Present*

Position: Research Scientist

Where: Stealth Startup

- Was the first (non-founder) employee at a quantum computing/machine learning startup, started by former team leads at Google, IBM, and BMW Quantum. Took a gap year from school to help build the initial versions of the company's core technology.
- Built the core code-base utilized for quantum simulation and probabilistic machine learning applications.
- Led the development of novel theoretical work and error bounds related to quantum algorithms for simulating large thermal states.

*April 2021—
September 2021*

Position: Quantum Algorithms Research Intern

Where: Xanadu Quantum Technologies

- Conducted research on quantum machine learning for generating approximate molecular ground states. Developed sample bounds for gradient calculations, Cramer-Rao lower bounds on data requirements for the model, and performed numerical simulations.
- Explored other research directions in the regime of fault-tolerant quantum algorithms for quantum chemistry, namely QSVT-based algorithms for simulation of molecular vibronic structure.

*April 2021—
September 2021*

Position: Quantum Research Resident
Where: Xanadu Quantum Technologies

- Conducted research on performing end-to-end quantum chemistry simulations on quantum computers, and new techniques for computing accurate energy derivatives on quantum devices.
- Built software on top of the PennyLane library for simulating quantum computational chemistry calculations.
- Developed the initial version of an automatically differentiable Hartree-Fock solver, for computing derivatives of molecular Hamiltonians and atomic basis set parameters.

*June 2020—
October 2020*

Position: Quantum Software Development Intern
Where: Xanadu Quantum Technologies

- Focused on development of Xanadu's quantum machine learning software library, PennyLane.
- Published tutorials on cutting-edge variational quantum algorithms implemented using PennyLane, such as the Variational Quantum Thermalizer, the Quantum Graph Neural Network, and the Quantum Approximate Optimization Algorithm (QAOA).
- Led the development effort to incorporate native QAOA functionality into PennyLane, in the `pennylane.qaoa` module.

Other Experience

*September 2022—
Present*

Position: Research Student
Where: University of Toronto

- Working with Prof. Nathan Wiebe on research related to extensions of Quantum Signal Processing and Quantum Singular Value Transforms, and novel techniques for Hamiltonian simulation.

*July 2019—
July 2019*

Position: Summer Student
Where: The Perimeter Institute for Theoretical Physics

- Participated in the International Summer School for Young Physicists at the Perimeter Institute.
- Took classes on basic concepts in modern physics (quantum mechanics, special relativity, etc.).
- Participated in a small seminar course on introductory Standard Model particle physics.
- Worked on a quantum information project with one of the IS-SYP mentors, Prof. Jamie Sikora, for several months after the program ended.

October 2019—
Present

Position: Qiskit Advocate
Where: IBM Quantum

- Credited with writing two sections for the Qiskit textbook on introductory linear algebra for quantum computing, and the Variational Quantum Linear Solver algorithm.

Selected Preprints and Publications

- **Jack Ceroni**, Torin F Stetina, Maria Kieferova, Carlos Ortiz Marrero, Juan Miguel Arrazola, Nathan Wiebe “*Generating Approximate Ground States of Molecules Using Quantum Machine Learning.*” arXiv preprint arXiv:2210.05489 (2022).
- **Jack Ceroni**, Alain Delgado, Soran Jahangiri, Juan Miguel Arrazola “*Tailgating quantum circuits for high-order energy derivatives.*” arXiv preprint arXiv:2207.11274 (2022).
- Juan Miguel Arrazola, Soran Jahangiri, Alain Delgado, **Jack Ceroni**, Josh Izaac, Antal Száva, Utkarsh Azad et al. “*Differentiable quantum computational chemistry with PennyLane.*” arXiv preprint arXiv:2111.09967 (2021).

Invited Talks

- North Carolina State University Quantum Workshop (January 2023). Talk title: *Generating Approximate Ground States of Molecules Using Quantum Machine Learning.*
- Quantum Technology and Application Consortium Journal Club (December 2022). Talk title: *Generating Approximate Ground States of Molecules Using Quantum Machine Learning.*

Honors and awards

- Weston Youth Innovation Award (2018)
- University of Toronto Scholars Award (2020)
- MITACS Accelerate Grant (2021, 2022)
- Haylon Chan Memorial Award (2022)
- University of Toronto Dean’s List (2021, 2022, 2023)