

Brett Henderson

Curriculum Vitae

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📍: Department of Chemistry, University of Victoria.
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Summary

I am a computational chemist interested in simulating nature with both classical and quantum algorithms. My current research involves ab initio molecular dynamics simulations on high performance computing clusters, but my vision is to help develop quantum chemical algorithms for quantum computers that can expand our computational toolkit far beyond its current capabilities.

Education

2019–present	Ph.D. Student in Chemistry	University of Victoria
2013–2017	A.B. Engineering Sciences—Electrical and Computer Engineering (Cum Laude in Field), Secondary Computer Science	Harvard University

Research Experience

2019–present **Ph.D. Candidate**, Paci Group University of Victoria

I work with a variety of open-source electronic structure codes and write my own code to fill in the gaps. Projects include: simulating the dielectric response of nanocomposite materials with quantum and coarse-grained models, direct dynamics simulations of chemical reactions, and quantum computational approaches to transition metal catalysis.

2016–2017 **Research Assistant**, Vecitis Lab Harvard University

I fabricated reduced graphene oxide supercapacitors and helped characterize the devices using cyclic voltammetry and X-ray photoelectron spectroscopy.

Employment History

2021–present **Quantum Computing Research Intern** Quantum Algorithms Institute

- Benchmark variational quantum algorithm performance for simulating oxygen reduction reaction pathways.
- Develop educational content and host virtual seminars.

2017–2018 **Emerging Technologies Systems Engineer** The MITRE Corporation

- Developed python application to use optical character recognition and natural language processing to automate the evaluation of captioned telephone services.
- Developed python code for automated cybersecurity red-teaming software for Linux machines.

Honors and Awards

2022	Graduate Award – Research Achievement, University of Victoria	\$1000
2022	1st Prize, Group Poster, QSciTech-QuantumBC Workshop	\$100
2021	1st Prize, Group Poster, QSciTech-QuantumBC Workshop	\$100
2020–2023	Quantum Computing NSERC CREATE program scholar	\$10,000 per annum
2020	Mohamed and Prabha Ibrahim Graduate Scholarship	\$1,080
2020	Graduate Award – Research Achievement, University of Victoria	\$1,367.33
2019–2021	Graduate Award – Academic Achievement, University of Victoria	\$1,500 per annum
2019	UVic Entrance Scholarship	\$10,000
2016, 2017	All-Academic Men's T&F Team, Track and Field Coaches Assoc.	
2015	Harvard College Scholarship Award	
2014	John Harvard Award, Harvard College	
2014	Detur Book Prize, Harvard College	

Manuscripts Published in Refereed Journals

1. Adluri, A. N. S., B. Henderson, and I. Paci (2022). Tuning the dielectric response in a nanocomposite material through nanoparticle morphology. *RSC Adv.* **12** (17), 10778–10787. doi: 10.1039/D1RA07472E.
2. Zhang, H., P. Moazzezi, J. Ren, B. Henderson, C. Cordoba, V. Yeddu, A. M. Blackburn, M. I. Saidaminov, I. Paci, S. Hughes, and R. Gordon (2022). Coupling Perovskite Quantum Dot Pairs in Solution using a Nanoplasmonic Assembly. *Nano Letters* **22**(13), 5287–5293. doi: 10.1021/acs.nanolett.2c01222.
3. McFarlane, J., B. Henderson, S. Donnecke, and J. Scott McIndoe (2019a). An information-rich graphical representation of catalytic cycles. *Organometallics* **38**(21). doi: 10.1021/acs.organomet.9b00563.

Submitted Manuscripts

1. Henderson, B., A. Adluri, and I. Paci (2022). Dielectric metal/metal oxide nanocomposites: modeling response properties at multiple scales. *ChemRxiv*. doi: 10.26434/chemrxiv-2021-s0vqp-v2.
2. Williams, P., C. Killeen, I. Chagunda, B. Henderson, S. Donnecke, W. Munro, J. Sidhu, D. Kraft, D. Harrington, S. McIndoe, and et al. (2022). Continuous Addition Kinetic Elucidation: Catalyst and Reactant Order, Rate Constant, and Poisoning from a Single Experiment. *ChemRxiv*. doi: 10.26434/chemrxiv-2022-52g7z.

Public Lectures

1. Henderson, B. (Nov. 2020a). “Playing Dice With the Universe: Harnessing the Weird Behaviour of Quantum Bits to Solve Real World Problems”. Nerd Nite Victoria.

Poster Presentations

1. Henderson, B., A. N. Adluri, and I. Paci (June 2022). “Finite Element Modeling of the Dielectric Response of Metal/Metal Oxide Nanocomposites”. CSTCC 2020.
2. Henderson, B., M. Khatami, and K. Wong (Feb. 2022). “Quantum Machine Learning Using Qiskit”. QSciTech-QuantumBC Virtual Workshop: Quantum Machine Learning.
3. Henderson, B., A. N. Adluri, and I. Paci (Aug. 2021). “Multiscale modelling of dielectric response in metal/metal oxide nanocomposites”. IUPAC CCCE 2021.
4. Henderson, B., I. Benek-Lins, and M. Mathews (Feb. 2021). “H2 ground state finder using Qiskit”. QSciTech-QuantumBC Virtual Workshop: Gate-based Quantum Computing Using IBM Q.
5. Henderson, B. and S. Donnecke (Nov. 2021). “Python-Powered Kinetic Analysis”. University of Victoria dept. of chemistry graduate student research day poster session.
6. Henderson, B., A. Adluri, and I. Paci (Mar. 2020). “Multi-scale modeling of polarization in metal oxide nanocomposites”. University of Victoria Ideafest - getting up to speed with nature’s imagination.
7. McFarlane, J., B. Henderson, S. Donnecke, and J. Scott McIndoe (May 2019b). “An information-rich graphical representation of catalytic cycles”. Inorganic Discussion Weekend, University of Victoria.

Teaching Positions

- 2021 **Teaching Assistant**, Chem477, Computational Chemistry
- 2020 **Teaching Assistant**, Chem 347, Quantum Chemistry
- 2020 **Laboratory Teaching Assistant**, Chem 260, Synthetic Chemistry Laboratory
- 2020 **Tutorial Instructor**, Chem 102, Chemical Reactivity Fundamentals with Environmental Applications
- 2019 **Laboratory Teaching Assistant**, Chem 150, Engineering Chemistry

Software

Many of my projects are available at <https://github.com/brettrhenderson/> or described in more detail at brettrhenderson.github.io. Here are several samples. Most of these projects Python, with a smattering of Javascript (and HTML/CSS). I have some experience with C, Java, and OCaml.

1. Henderson, B. (2020b). “PyBEC”. Extract and manipulate born effective charges from QuantumEspresso output files. <https://github.com/brettrhenderson/pybec>.
2. Henderson, B. (2020c). “PyFractals”. Animation of sierpinski triangle construction via binary tree method. <https://github.com/brettrhenderson/pyFractals>.

3. Henderson, B. (2020d). "PySims". A collection of classical mechanics simulations using python. <https://github.com/brettrhenderson/PySims>.
4. MacFarlane, J., B. Henderson, and S. Donnecke (2019). "Catacycle". An information-rich graphical representation of catalytic cycles. <https://github.com/brettrhenderson/Catacycle>.
5. Sun, A., N. Cable, and B. Henderson (2013). "Pacman: revenge of blinky". CS50 final project. <https://github.com/brettrhenderson/pacboi>.