Daniel Barter

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Bio

I am a software engineer, working in scientific and high performance computing, mostly writing simulators. I have worked on simulators for

- 2D gapped topological phases of matter
- Lithium and Magnesium ion batteries
- Linear optical quantum systems

Employment

- **PsiQuantum.** November 2022 - . Computational Physicist. Working on quantum optics simulators.
- **Google.** May 2022 - September 2022. Software Engineer. Worked on Android auto, mostly networking related stuff. Contributed to Stim.
- **Lawrence Berkeley National Laboratory.** November 2020 - May 2022. Postdoctoral Fellow in the Applied Energy Materials Group. Worked on short time scale simulations of metal ion batteries. Built RNMC and HiPRGen.
- **Mercury Technologies.** April 2020 - August 2020. Software Engineer. Worked on backend server written in Haskell.
- **University of California, Santa Barbara.** September 2019 - March 2020. Lecturer and Postdoctoral Fellow. Course coordinator for Calculus 4.
- **Australian National University.** February 2018 - August 2019. Postdoctoral fellow. Worked on constructing new exactly solvable quantum field theories using tools from algebraic topology and low dimensional category theory.
- **University of Sydney.** August 2017 - January 2018. Postdoctoral researcher in Physics. Learned quantum field theory by interacting with researchers in condensed matter physics and quantum information theory.
- **University of Michigan.** September 2012 - May 2016. Graduate student instructor for calculus 1, 2 and 3. Taught classes with 20-30 students, three times a week. Held office hours. Helped students use Mathematica. Graded homework/exams.
- **University of Sydney.** March 2011 - June 2012. Tutor for calculus 1 and 2. Supervised problem sessions and graded homework/exams.

Education

- PhD, Mathematics, University of Michigan. September 2012 - May 2017. Specialized in representation theory. Thesis: Some Remarks about the Interaction between Quantum Algebra and Representation Stability.
- B.Sc with First Class Honours and University Medal, Pure Mathematics, University of Sydney. March 2008 - December 2011.

Software

- **C++** : Good debugging skills. Some of my favorite libraries and tools: sqlite, pybind11, gdb, perf. I have some experience using OpenMP, OpenMPI and OpenCL.
- **Python** : Comfortable with the python/C interface and core parts of the python scientific computing ecosystem: numpy, scipy, matplotlib, py-spy, memray, pydantic. I have some experience using jax and pytorch. I am really good at using pdb.
- **Linux** : Good understanding of Linux user space. Comfortable on any Linux system running bash, tmux and emacs. Check out my NixOS configuration which specifies all my personal machines.

Papers

- doi:10.26434/chemrxiv-2023-tntkg-v2. Chemical Reaction Networks Explain Gas Evolution Mechanisms in Mg-Ion Batteries. Joint work with Evan Spotte-Smith, Sam Blau and others.
- doi:10.26434/chemrxiv-2022-n236n. Towards a Mechanistic Model of Solid-Electrolyte Interphase Formation and Evolution in Lithium-ion Batteries. Joint work with Evan Spotte-Smith, Ronald Kam and others.
- doi:10.26434/chemrxiv-2021-c2gp3. Predictive stochastic analysis of massive filter-based electrochemical reaction networks. Joint work with Evan Spotte-Smith, Sam Blau and others.
- arXiv:2110.03644. Computing associators of endomorphism fusion categories. Joint with Jacob Bridgeman and Ramona Wolf. **Published** in SciPost.
- arXiv:1907.06692. Computing data for Levin-Wen with defects. Joint with Jacob Bridgeman. **Published** in Quantum.
- arXiv:1901.08069. Computing Defects Associated to Bounded Domain Wall Structures: The $\mathbf{Vec}(\mathbb{Z}/p\mathbb{Z})$ case. Joint with Jacob Bridgeman. **Published** in Journal of Physics A.
- arXiv:1810.09469. Fusing Binary Interface Defects in Topological Phases: The $\mathbf{Vec}(\mathbb{Z}/p\mathbb{Z})$ case. Joint with Jacob Bridgeman and Corey Jones. **Published** in Journal of Mathematical Physics.
- arXiv:1806.01279. Domain walls in topological phases and the Brauer-Picard ring for $\mathbf{Vec}(\mathbb{Z}/p\mathbb{Z})$. Joint with Jacob Bridgeman and Corey Jones. **Published** in Communications in Mathematical Physics.
- arXiv:1706.03645. Deligne categories and representations of the infinite symmetric group. Joint with Inna Entova-Aizenbud and Thorsten Heidersdorf. **Published** in Advances in Mathematics.
- arXiv:1611.00071. Eigenvalues of rotations and braids in spherical fusion categories. Joint with Corey Jones and Henry Tucker. **Published** in Journal of Algebra.
- arXiv:1610.05204. Computing the minimal model for the quantum symmetric algebra.
- arXiv:1610.05248. A remark about 6j symbols and young semi-normal form.
- arXiv:1509.04228. Noetherianity and rooted trees.