# Eliot Heinrich

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eliotheinrich.github.io

## Summary

Graduating PhD candidate in computational physics specializing in quantum simulation and large-scale numerical experiments. Skilled in designing and optimizing high-performance scientific software and scalable simulations in distributed environments. Seeking to apply these skills to role in software engineering.

## Education

**Boston College** Sept. 2020 – May 2026
*Physics (PhD, MS), GPA: 3.96*

**University of Vermont** Sept. 2016 – May 2020
*Computer Science (BS), Physics (BA), Mathematics (BS), GPA: 3.91*

## Experience

**Ph.D Candidate, Quantum Simulation Research, Boston College** Sept. 2020 – Present
- Engineered simulator architecture enabling efficient, parallelized quantum circuit trajectory simulations.
- Produced five first-author publications related to statistical mechanics, quantum information, large-scale numerical studies, and classical algorithms for simulating/characterizing quantum systems.

**HPC Research Assistant, Boston College Research Services** Jan. 2023 – Present
- Systems administrator for Boston College's Linux HPC cluster (284 nodes, ~500 users).
- Assisted 35+ interdisciplinary research groups to design, deploy, and utilize scientific software.
- Developed Python-based automated tools for job scheduling, cluster usage data aggregation/visualization, and performance monitoring.
- Authored documentation/best-practice guides for parallel computing, OpenMP, MPI, Linux, and Python.

**Quantum Theory & Software Intern, MIT Lincoln Laboratory** June 2022 – Aug. 2022
- Designed and implemented sparse-vector qutrit simulator in C++, extending simulator codebase to model new quantum error channels.

## Projects / Publications

Full list of publications available at eliotheinrich.github.io/publications
More projects, including interactive WebGL applets, available at eliotheinrich.github.io/projects

**qutils (C++/Python API)** github.com/eliotheinrich/qutils
- Modular quantum simulation library supporting simulator backends representing various simulable subtheories of quantum mechanics (i.e. stabilizer states, tensor networks, free fermion dynamics).
- Flexible simulator-agnostic circuit representation represents symbolic quantum/classical instructions.
- Leveraging SIMD instructions, circuit transpilation, and algorithmic optimization, simulators outperform standard libraries by up to an order of magnitude on comparable tasks.
- Authored extensive unit tests to validate numerical accuracy and benchmark performance.

**dataframe (C++/Python API)** github.com/eliotheinrich/dataframe
- Built a parallelized config-based data pipeline that executes arbitrary simulations across parameter sweeps via multiprocessed Python.
- Data stored in database written in native C++, supporting efficient query of statistical properties filtered by model parameter values, allowing for efficient downstream analysis.

**learning_magic (Python)** github.com/eliotheinrich/learning_magic
- Using PyTorch and qutils, estimated magic (stabilizer entropy) of tensor network states with <5% mean squared error on spin-chain ground states using recurrent convolutional neural networks.

## Skills

*Languages/Software*: C++, CMake, Python, Rust, Git/GitHub, Linux, LaTeX, PyTorch, SQL
*Techniques*: High-performance parallel computing, advanced numerical methods, designing numerical experiments, data visualization, API design, debugging, optimization, profiling, scalable code design, technical communication, machine learning, deep learning