Sam Fine

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EDUCATION

The University of Chicago   **Expected December 2025**
M.S., Computer Science   *Chicago, IL*

The University of Chicago   **June 2025**
B.S., Mathematics, minor in Physics   *Chicago, IL*

Relevant Coursework:
Graduate: Quantum Measurements and Metrology, The Physics of Computation, Adv Classical Mechanics, Quantum Computer Systems, Distributed Systems, Introduction to Machine Learning
Undergraduate: Hon. Algebra I-III, Analysis in Rn I-III (accelerated), Hon. Discrete Math, Hon. Theory of Algorithms, Quantum Mechanics I & II, Mathematical Foundations of Machine Learning, Computational Physics

RESEARCH INTERESTS

Theory, design and control of physical systems that can represent and manipulate quantum information. I am particularly drawn toward two intersections of quantum computing theory and application:

- *Overcoming Noise:* Methods to more efficiently encode and process quantum information that minimize control complexity and error susceptibility in resource-limited, near-term devices.
- *Characterization:* Developing the theory and computational tools to calibrate and control quantum systems.

RESEARCH EXPERIENCE

Quantum Error Correction for Correlated Noise   **June 2025 - Present**
Advised by Liang Jiang   *Chicago, IL*
- Designing and verifying teleportation-based fault-tolerant protocols for correlated noise.
- Explored the sample complexity of machine-learning based surface code decoders for higher-order errors.

Robust Quantum Optimal Control   **May 2025 - Present**
Advised by Fred Chong   *Chicago, IL*
- Discovered and repaired a discretization error in a standard robustness metric for quantum optimal control.
- Studied the theoretical and practical trade-offs between control complexity and error susceptibility.
- Working to run robust controls on quantum hardware to show performance gain with the corrected metric.

Fermilab Mu2e Internship   **June - Aug 2024**
Advised by Andrei Gaponenko   *Batavia, IL*
- Developed the model of the Mu2e Extinction Monitor detector for a radiation shielding assessment.
- Wrote and refactored C++ code that captured the complex geometries and constraints of the detector.

Higgs Boson Self-Coupling Classification   Jan 2023 - Jan 2024
Advised by Philipp Windischhofer   *Chicago, IL*
- Investigated how modern machine learning methods can help to extract the maximum amount of information about the self-interactions of the Higgs boson from the data sets recorded at the LHC.
- Applied neural networks to define highly-compressed, information-preserving statistics of the original data.

SLAC Technology Innovation Directorate Intern   **2020 - 2021**
Advised by Emilio Nanni   *Stanford, CA*
- Studied the physics of the Cool Copper Collider: an advanced e^+e^- linear collider concept in the TeV class.
- Explored efficient normal-conducting particle accelerator design and built the website.

Designed & Built a 300 KeV Cyclotron   **2016 - 2021**
Advised by Martin Breidenbach   *Stanford, CA*
- Co-led project to build a 300 KeV cyclotron.
- Designed, constructed and tested vacuum, radiofrequency, ion source and detector systems.

PUBLICATIONS & PREPRINTS

A. Kamen, **S. Fine**, B. Bhattacharyya, F. Chong, A. Goldschmidt. Accurate metrics for robustness in quantum optimal control. (in preparation)

AWARDS & RECOGNITION

Metcalf Research Grant ($4,500)   **2024**
UC Berkeley Regents' & Chancellor's Scholarship (~0.2% of all applicants selected, declined)   **2020**

VOLUNTEERING & SERVICE

South Side Science Fair Volunteer   **2025**
Phoenix Outdoor Program Leader   **2021-2024**

CERTIFICATIONS, SKILLS & INTERESTS

Languages: Julia, Python, C++
Libraries: Piccolo.jl, NumPy, pandas, PyTorch, Matplotlib, QuTiP, SciPy
Interests: Backpacking; Biking; Rock Climbing; Reading