

# Sam Fine

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## EDUCATION

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### The University of Chicago

*M.S., Computer Science*

**Expected December 2025**

*Chicago, IL*

### The University of Chicago

*B.S., Mathematics, minor in Physics*

**June 2025**

*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  $\mathbb{R}^n$  I-III (accelerated), Hon. Discrete Math, Hon. Theory of Algorithms, Quantum Mechanics I & II, Mathematical Foundations of Machine Learning, Computational Physics

## RESEARCH INTERESTS

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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

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### 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*

- Running experiments on quantum hardware to show measurable improvement using the corrected metric.
- 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.

### 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

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

## AWARDS & RECOGNITION

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Metcalf Research Grant (\$4,500)

2024

[UC Berkeley Regents' & Chancellor's Scholarship](#) (~0.2% of all applicants selected, declined)

2020

## VOLUNTEERING & SERVICE

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[South Side Science Fair](#) Volunteer

2025

Phoenix Outdoor Program Leader

2021-2024

## CERTIFICATIONS, SKILLS & INTERESTS

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**Languages:** Julia, Python, C++

**Libraries:** [Piccolo.jl](#), NumPy, pandas, PyTorch, Matplotlib, QuTiP, SciPy

**Interests:** Backpacking; Biking; Rock Climbing; Reading