Owen Root

New York, NY oroot@gradcenter.cuny.edu +1 (913) 370 1812 yagoiroot

Education

CUNY Graduate Center, New York, NY — *Expected May 2028*
Ph.D., Physics

- GPA: 3.64 / 4.00

Nebraska Wesleyan University, Lincoln, NE — *May 2023*
B.S., Physics; Minors in Mathematics and Political Science

- GPA: 3.62 / 4.00

Research Interests

Quantum information theory; quantum randomness and foundations; event-based / neuromorphic vision and computational optics; numerical methods for quantum dynamics. I am particularly interested in machine learning and artificial intelligence, especially generalization and training dynamics in deep neural networks (for example, "grokking" phenomena).

Publications

Owen B. Root, Julinda Mujo, and Min Xu "A unified probabilistic event camera model for noise, step-response curves, and parameter determination", *Proc. SPIE 13908, Quantum Sensing and Nano Electronics and Photonics* XXII, 139080J(2026).

Jessica Burns, **Owen Root**, Hui Jing, and Imran M. Mirza, "Engineering optomechanically induced transparency by coupling a qubit to a spinning resonator," *J. Opt. Soc. Am. B* **40**, 958–965 (2023).

Preprints and Other Publications

Owen Root, "Deterministic Discrimination of Phase-Modified Permutation Oracles via Single Qubit Measurement," arXiv:2603.07756 (2026).

Owen Root, "Expression for $g(k)$ related to Waring's problem," arXiv:2508.17950 (2025).

Owen Root and Maria Becker, "Does true randomness exist? Efficacy testing IBM quantum computers via statistical randomness," arXiv:2401.12250 (2024).

Owen Root, "Robocode battle builds bridges," *The SPS Observer* **56**(3), Society of Physics Students / American Institute of Physics, 1 Feb. 2023. Available online: https://students.aip.org/observer/robocode-battle-builds-bridges

Research Experience

Founder and Lead Investigator — *New York, NY*
RootML – Independent Machine Learning Research Lab — *Mar 2026 – Present*

- Founded an independent research lab focusing on machine learning for language models.
- Developed and deployed root-sprout, a multi-model orchestration system that coordinates queries across independent LLMs via a staged fan-out architecture with hierarchical aggregation.
- Conducting ongoing research into political bias in large language models, including prompt-sensitivity analysis, variance decomposition methodology, and mixed-effects modeling of survey-instrument responses across multiple LLM providers.
- Investigating analytic alternatives to numerical computation in scientific and mathematical contexts using language models.

Graduate Research Assistant — *New York, NY*
CUNY Graduate Center and Hunter College — *Aug 2023 – Present*

- Developed an analytical statistical model for neuromorphic / event-based cameras that jointly describes signal-driven and noise-induced events.
- Designed experimental methods to infer unknown physical properties of an event camera from recorded event streams using the analytical model.
- Trained U-Net architectures with self attention to reconstruct still images from event-camera noise for model validation.
- Developed a quantum algorithm that distinguishes phase-modified unitary oracles using a single-qubit measurement.
- Built a numerical simulation suite for time-dependent Schrödinger dynamics with time-dependent and non-trivial boundary conditions.
- Implemented analysis tools for numerical simulations of quantum dynamics in large biological molecules.
- Created a program that uses clustering and genetic programming to infer analytic functional forms from hand-drawn plots.

Undergraduate Research Assistant *Lincoln, NE*
Nebraska Wesleyan University *Aug 2020 – May 2023*

- Investigating statistical randomness in IBM quantum computers:
  - Used IBM quantum devices to generate random bit strings from measurements of superposition states.
  - Applied statistical tests grounded in probability theory to quantify deviations from ideal randomness and to compare with classical pseudo-random number generators.
  - Discussed implications for cryptography and other applications that require high-quality randomness from quantum devices.
- Simulation and investigation of quantum phenomena using an acoustic double slit:
  - Designed and operated an acoustic double-slit apparatus with controlled phase and timing of sound waves.
  - Used acoustic interference patterns as an accessible analog to illustrate the wave nature of quantum mechanics.
  - Examined how loss of coherence suppresses interference and connected these effects to limitations on quantum technologies such as quantum computers.

Physics REU Student *Oxford, OH*
Miami University *July 2022 – Aug 2022*

- Investigated probe-light transmission in a spinning optomechanical ring resonator coupled to a single qubit with applications to nonreciprocal photonic devices and quantum information processing.
- Analyzed how strong qubit–resonator coupling modifies transmission for clockwise versus counterclockwise rotation.
- Demonstrated that a strongly coupled qubit enhances transmission only for clockwise rotation, indicating a direction-dependent optical response.

Open-Source Software

LLM Query Functions *2026*

- A Python library providing standardized wrapper functions for querying large language models from multiple providers (OpenAI, Perplexity, DeepSeek, xAI/Grok, Moonshot/Kimi) through a unified interface.
- Each function handles client initialization, parameter validation, token usage tracking, and cost estimation, enabling provider-agnostic experimentation with minimal code changes.

PyCharm Plot Toggle *2026*

- A Kotlin plugin for PyCharm Professional that adds a one-click toolbar toggle to switch matplotlib plot display between the tool window and the pop-up window, avoiding repeated navigation through the settings dialog.
- Available on the JetBrains Marketplace; targets PyCharm 2024.3+.

Awards and Fellowships

Graduate Assistant Fellowship for graduate study, CUNY Graduate Center and Hunter College — Aug 2023 – Present

French Foundation Scholarship for collegiate study — Aug 2019 – Present

STEM Scholarship for undergraduate study, Nebraska Wesleyan University — Aug 2019 – May 2023

Conferences

SPIE Photonics West — 2026
- Contributed oral presentation.

Nebraska Research & Innovation Conference — 2024
- Contributed poster presentation.

Optica Frontiers in Optics — 2022
- Contributed oral presentation.

Society of Physics Students Physics and Astronomy Congress — 2022
- Contributed poster presentation.

Leadership and Service

President, Society of Physics Students (SPS) Chapter, Nebraska Wesleyan University — May 2021 – May 2023
- Led revitalization of the local chapter following the COVID-19 pandemic.
- Organized multiple interdepartmental student events and recruitment activities.
- Planned and executed a chapter trip to the 2022 SPS Physics and Astronomy Congress in Washington, DC.

Teaching Experience

Graduate Adjunct Lecturer, Department of Physics and Astronomy, Hunter College — Aug 2024 – Present
- Prepare and lead weekly instructional laboratories for introductory physics courses.
- Grade lab reports and practical exams and collaborate with course instructors on final grades.

Physics Tutor, Cooper Center, Nebraska Wesleyan University — Aug 2021 – May 2023
- Provided one-on-one and small-group tutoring for undergraduate physics students.
- Developed study strategies and review sessions to help students prepare for exams.

Skills

Programming and data analysis: Python, Kotlin, Qiskit, LaTeX, Mathematica, R.

Operating systems: Windows, macOS, UNIX / Linux.

Media software: Adobe Photoshop, Adobe Premiere.