Alex Leonardi

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Researcher with experience in quantum computing, machine learning, and differential geometry.

Education

Harvard University — Cambridge, MA
A.B. Physics and Mathematics. High Honors in Physics and Mathematics. Cum Laude in Physics and Mathematics. — May 2025
Relevant Coursework: Intro to Quantum Info (Graduate), Topics in Quantum Info (Graduate), Mathematical Methods of Modern Physics (Graduate), General Relativity (Graduate), Differential Geometry (Graduate), Lie Groups and Lie Algebras (Graduate), Advanced Laboratory, Solid State Physics, Laser Physics and Quantum Optics, Statistical Mechanics and Thermodynamics, Electrodynamics

Hunter College High School — New York, NY
Silver Medal at Level 4 National Spanish Exam. Hunter Math team, Robotics team, and Varsity Fencing team. 1st Place at New York Google HQ Hackathon, Summer 2019. — June 2021

Experience

Jaffe Group, Harvard Physics Department — Cambridge, MA
Researcher — April 2025 – Present
- Project: Reflection Positivity and Quantum Error Correction in (n+1) Alterfold TQFT
- Project: Quantum Complexity in the Clifford Hierarchy
- Mentored by Prof. Arthur Jaffe

REU CAAR at University of Maryland — College Park, MD
Quantum Error Correction Researcher — June 2024 – August 2024
- Computed braiding statistics for modified color codes and their associated Two-block CSS codes.
- Worked on classification of associated topological orders.
- Paper in development.
- Mentored by Prof. Victor V. Albert and Dr. Nathanan Tantivasadakarn.

Brookhaven National Laboratory — Upton, NY
Quantum Computing Intern — June 2023 – August 2023
- Researched efficient state-preparation algorithms with nonlocal and nonunitary resources for topologically ordered states, to generate long-range entanglement.
- Presented poster at conference and co-authored an internal paper.
- Mentored by Prof. Layla Hormozi.

University of California, Santa Barbara — Santa Barbara, CA
Machine Learning Researcher — June 2019 – July 2019
- Co-authored paper, On the Dynamics of Bitcoin in Relation to Social and Economic Indicators, available on Github. Implemented multiple linear regression model optimized with gradient descent.
- Received an A in college-level machine learning class, earning 4 college credits.
- Mentored by Dr. Shadi Mohagheghi

Awards & Leadership

1st Place in QuEra Challenge — Cambridge, MA
MIT iQuHack Hackathon — February 2025
- Transpiled circuits in native gateset using IBM's Qiskit, Google's Cirq, and Quantinuum's TKET with further manual optimization using CZ commutation relations and global gates.
- Used graph coloring approach to optimize initialization of qubit gate zone register and subsequent shuttling (ie reconfiguration)
- Analyzed larger circuits with Quantum Approximate Optimization Algorithm (QAOA).
- Contributed ideas to automation of Bloqade code generation.
- Team Member of Good Qubits team.

Harvard Undergraduate Automotive Society — Cambridge, MA
Director of Racing — 2023 – 2024
- Created competitive go-kart racing league and also hosted karting events for newcomers.
- Collaborated with Engineering team on electric go-kart conversion.
- Established relationships with vendors and professional go-karting facilities. Hosted races with MIT.

Skills & Interests

Technical: Python (SymPy, NumPy, Pandas, Sklearn) / Mathematica / C / C++ / SQL / JavaScript / HTML / CSS / LaTeX / Excel
Languages: English (Fluent) / Spanish (Fluent) / Russian (Conversational)
Laboratory: Interferometry / Radiation Sources (Lasers) / Laser Safety / Spectroscopy / Microwave Hardware & Electronics / High Vacuum Gas Handling Techniques / Mass Measurements / Valves / Instrumentation Calibration / Gas Handling Systems / Oscilloscopes / LabView / Manipulating Time Series Data / Statistics & Statistical Analysis / Cryogenic Systems and Testing
Interests: Fencing