Luke Qi

Undergraduate Student · Department of Physics · Department of Electrical Engineering and Computer Science

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Education

Massachusetts Institute of Technology *Cambridge, MA*

Candidate for S.B. in Physics, S.B. in Electrical Engineering *Sep. 2017 - Present*

- Advisors: Prof. Rajeev Ram, Prof. Joseph Formaggio
- GPA: 5.0/5.0
- Select Courses: Quantum Information Science II, Photonics, Experimental Physics, Machine Learning, Quantum Nonlocality Quantum Mechanics I, II & III, Analog Electronics Laboratory, Electromagnetics and Applications, Statistical Mechanics

Research Experience

Photonics and Modern Electro-Magnetics Group *Cambridge, MA*

Undergraduate Researcher *Feb. 2021 - Present*

- Advisors: Prof. Marin Soljacic, Dr. Yi Yang
- Studying quantum walker protocols immersed in non-Abelian gauge fields
- Deriving quasienergy dispersions and topological phase transitions of an effective Hamiltonian

Nanostructures and Computation Group *Cambridge, MA*

Undergraduate Researcher *Feb. 2021 - Present*

- Advisors: Prof. Steven Johnson, Dr. Raphael Pestourie
- Developing a fast approximate Maxwell solver for layered photonic devices with delta function permittivities and periodic boundary conditions

MIT Quanta Group *Cambridge, MA*

Keel Foundation Undergraduate Research and Innovation Scholar *Aug. 2019 - Present*

- Advisors: Prof. Isaac Chuang, Dr. John Chiaverini, Mr. Jules Stuart, Dr. Jeremy Sage
- Launched a collaboration with Gonzalo Muga's group to develop robust Shortcuts-to-Adiabaticity protocols based off my simulation results. Review paper in progress
- Developed a full end-to-end numerical simulation pipeline to optimize voltage waveforms in future ion shuttling experiments
- Built remote laser shutter controllers and characterized the system's high-voltage amplifier

MIT Aerospace Controls Lab *Cambridge, MA*

Undergraduate Researcher *Sep. - Dec. 2018*

- Advisors: Prof. Jonathan How, Dr. Golnaz Habibi
- Implemented human detection algorithms on a system with one Velodyne lidar and six RGB cameras
- Built a full computer vision pipeline to extract human trajectories and collected data throughout Boston

Industry Experience

Trace Matters Scientific *Somerville, MA*

Hardware Intern *Feb. - Aug. 2019*

- Advisor: Dr. Mazdak Taghioskoui
- Built a backend data acquisition system for the company's prototype mass spectrometer using a PYNQ System-on-a-Chip
- Implemented a quadropole mass filter controller and low-latency communication with front-end server

The Aerospace Corporation *Los Angeles, CA*

Innovation Lab Intern *Jun. - Aug. 2018*

- Advisor: Dr. Will Bezouska
- Developed computer vision algorithms that work in space using point cloud data and AR tags
- Programmed two Arduino robots with PID controls and infrared communication to demonstrate swarm robotics techniques

Awards, Fellowships, & Grants

2019 **Undergraduate Research and Innovation Scholar**, Keel Foundation *$ 6,000*

2017 **Top Academic Student**, Fayetteville-Manlius High School
Bronze Medal, United States Physics Olympiad

2016 **Silver Medal**, International Olympiad on Astronomy and Astrophysics
Semifinalist, National Merit Scholarship Corporation *$ 2,500*

2015 **Bronze Medal**, International Olympiad on Astronomy and Astrophysics

Published Work

Poster Sessions

Qi, L. *Ion Motion Protocols for a Large Scale Quantum Computer*. MIT SuperUROP Showcase, 5 December 2019.

Presentations

Qi, L. *Shuttling Ions in a Quantum CCD Device: A Numerical Approach.* Quanta Group Meeting, 17 July 2020.

Taghioskoui, M., Qi, L. *Low-Pressure ICP-MS for Planetary Trace Elemental Analysis.* Harsh-Environment Mass Spectrometry Workshop, 16-19 September 2019, Myrtle Beach, SC.

Submitted Work

Qi, L., et al., 2016, *New Observations of Near-Earth Asteroid 138847 (2000 VE62),* M.P.S. 721480/M.P.C. 100734.

Outreach & Professional Development

Service and Outreach

Fall 2020 – **MIT Interdisciplinary Quantum Information Science and Engineering**, Outreach & iQuHACK Committees

Leadership

F. 2018–20 **MIT Ridonkulous Dance Team**, Captain, VP External

Teaching and Grading

Fall 2020 **6.003 Signal Processing**, HKN Tutor
Fall 2019 **6.002 Circuits and Electronics**, Lab Assistant
8.022 Physics II, Grader
Fall 2018 **8.03 Physics III**, Grader

Class Projects

Fall 2020 **6.621 Fundamentals of Photonics**, The Frontiers of Deep Learning and Nanophotonics
6.S979 Quantum Nonlocality, A survey on the Verifier-on-a-Leash and Dog-Walker protocols
21A.504 Cultures of Computing, Quantum Computing: Cultural Dimensions and Cultural Shifts
Spr 2020 **8.06 Quantum Physics III**, Physics of Quantum Dots: the Brus Equation and the Jaynes-Cummings Model
6.101 Analog Electronics Lab, Sigma Delta Analog-to-Digital Converter
Fall 2018 **18.353 Nonlinear Dynamics: Chaos**, Dynamics of the Interplanetary Transport Network

Skills

Software **Python: (SciPy, NumPy, PyTorch), SPICE, Xilinx Vivado, Verilog, C++, ROS, Linux, MATLAB, KiCAD**,
Hardware **Arduino, Pynq SoC, Oscilloscopes, VNA, PCB design, FPGA programming**,