

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, Deep Learning, Quantum Nonlocality, Quantum Mechanics I, II & III, Analog Electronics Laboratory, Signal Processing, Inference, Electromagnetics and Applications, Statistical Mechanics, Nonlinear Dynamics, Differential Equations

Research Experience

MIT Quanta Lab

Cambridge, MA

KEEL FOUNDATION UNDERGRADUATE RESEARCH AND INNOVATION SCHOLAR

Aug. 2019 - Present

- Advisors: Prof. Isaac Chuang, Dr. John Chiaverini, Dr. Jeremy Sage
- Launched a collaboration with Gonzalo Muga's group to develop robust Shortcuts-to-Adiabaticity protocols based off my simulation results. Aiming to achieve the first experimental results of these optimal ion shuttling protocols
- Created an ion shuttling simulator with Python and SPICE. Finding globally optimal voltages for transporting and splitting ion chains with SciPy gradient-descent methods
- Developed a full end-to-end numerical simulation pipeline to be used in future ion shuttling experiments, contributing to the scalability of trapped-ion quantum computers
- Experimental work includes building remote laser shutter controllers and flashing ARTIQ hardware.

MIT Aerospace Controls Lab

Cambridge, MA

UNDERGRADUATE RESEARCHER

Sep. - Dec. 2018

- Advisors: Prof. Jonathan How, Dr. Golnaz Habibi
- Implemented state-of-the-art depth clustering and online learning algorithms for human detection and classification on a 3D Velodyne LIDAR. Improved the range and sensitivity compared to the previous dynamic means-clustering algorithm
- Fused LIDAR output with the Single Shot Multibox Detector algorithm to decrease false positives and increase reliability of the new data-processing pipeline. Wrote a Python script to parse and plot trajectories outputted by the new pipeline

Industry Experience

Trace Matters Scientific

Somerville, MA

HARDWARE INTERN

Feb. - Aug. 2019

- Advisor: Dr. Mazdak Taghioskoui
- Built a customized quadrupole mass filter controller and oscilloscope with Xilinx's PYNQ System-on-a-Chip board, which was used directly by the company as the backend signal processor of a prototype mass spectrometer
- Implemented low-latency communication with the front-end DigitalOcean server to visualize sample data and calibrate system in real time

The Aerospace Corporation

Los Angeles, CA

INNOVATION LAB INTERN

Jun. - Aug. 2018

- Advisor: Dr. Will Bezouska
- Developed and integrated computer vision algorithms in ROS to autonomize rendezvous and proximity operations. Utilized Augmented Reality tags and Point Cloud Library for pose estimation
- Programmed two line-following Arduino robots with PID controls and infrared communication capabilities to demonstrate swarm robotics techniques

Awards, Fellowships, & Grants

- 2019 **Undergraduate Research and Innovation Scholar**, Keel Foundation \$ 6,000
- 2017 **Valedictorian**, 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 Committee

LEADERSHIP

Fall 2018 – **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,**