Luke Qi

UNDERGRADUATE STUDENT · DEPARTMENT OF PHYSICS · DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

8318 Prestwick Drive, Manlius, NY 13104

✉ lukeqi.7@gmail.com | 🔗 linkedin.com/in/luke-qi/ | 🐦 @lukeqi77

Education

Massachusetts Institute of Technology   *Cambridge, MA*

CANDIDATE FOR S.B. IN PHYSICS, S.B. IN ELECTRICAL ENGINEERING   *Sep. 2017 - Present*

- Advisor: Prof. Rajeev Ram
- GPA: 5.0/5.0
- Select Courses: Photonics, Experimental Physics, Machine 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,**