Joseph T Iosue

jiosue@mit.edu jtiosue@gmail.com (301)-980-9525

Education

Massachusetts Institute of Technology ***MA – Class of 2019***

- Bachelor of Science in Physics and minor in Computer Science – GPA 4.9/5.0.
- *Relevant courseware:* Experimental Physics, Quantum Mechanics III, Statistical Physics II, Relativity, Intro to Numerical Analysis, Classical Mechanics III, Linear Algebra, Computational Structures, Intro to Algorithms, Intro to Machine Learning, Mathematics for Computer Science, E&M, Fundamentals of Programming, Programming in Python.

Future Employment

QC Ware, Corp: Quantum Algorithms Researcher ***CA; Jan 2019 – Aug 2019***

- I will be working for QC Ware until I begin my PhD studies. I will be developing algorithms for near-future quantum computers and working in enterprise collaborations that target real-world use cases for quantum processing.

Research

MIT UROP: Laboratory for Nuclear Science (Hen Lab) ***MA; Sep 2017 – Present***

- I studied proton vs neutron dynamics in asymmetric nuclei and short range deuteron clustering in nuclei. We worked in collaboration with Thomas Jefferson National Accelerator in Virginia, using data collected there for our analysis. I worked alongside a graduate student and perform data analysis using C++ and ROOT. This includes particle identification and various detector specific work such as acceptance and fiducial analysis for ^{3}He and ^{4}He(e,e'p) and (e,e'd) reactions. Our goal was to filter out inelastic reaction channels so as to compare quasielastic collisions with theoretical models.

Los Alamos National Lab: Quantum Computing Summer Fellowship ***NM; June 2018 – Aug 2018***

- The fellowship lasted ten weeks, with the first two weeks being reserved for lectures and the following eight weeks for research.
- I studied variational quantum-classical hybrid algorithms. We published a novel quantum circuit for learning a unitary to diagonalize a Pauli Hamiltonian and implementing the time evolution unitary via this diagonal Hamiltonian in a short depth circuit for application to quantum simulation on a quantum computer. With this method, the depth of the time evolution operator is independent of the amount of time that the system is being evolved; this is in contrast to the well-known Trotter decomposition. For a large class of Pauli Hamiltonian's, our method is advantageous over Trotter decomposition because it has time independent depth and it is less approximate. After we worked out the initial theory, I was responsible for implementing our algorithm on IBM and Rigetti's simulator and quantum computer for the transverse field Ising model and determining how our algorithm converged to the exact diagonalization. We plan to publish our results soon.

Joint Quantum Institute, University of Maryland ***MD; May 2017 – Sep 2017***

- Worked alongside a postdoc to model short and long range interacting fermionic spin chains and Kitaev wires, focusing on how magnetic field and interaction strength parameters affect the steady state of the system. We studied the relationship between dynamical and quantum phase transitions via quench dynamics in integrable and nearly-integrable systems. Our paper is on arXiv (arXiv:1809.06377) and we will be submitting to PRL soon.
- Acknowledged for work in a separate project – (Nature24654) *Observation of a Many-Body Dynamical Phase Transition with a 53-Qubit Quantum Simulator*.

MIT UROP: Plasma Science and Fusion Center ***MA; Jan 2016 – May 2016***

- Worked with a professor to model particle acceleration and transport in turbulent media using C. We focused particularly on an electron's E cross B drift about its guiding center in spatially and time varying fields.

MIT UROP: Department of Nuclear Science and Engineering ***MA; Sep 2015 – Dec 2015***

- Worked with a graduate student to model thermal and mechanical responses of nuclear waste storage canisters to Traveling Wave Reactor (TerraPower) fission waste using finite element software ADINA.
- Tested a proposed pin and filler structure against the model we generated.

Publications

- P. Titum, **J. T. Iosue**, J. R. Garrison, A. V. Gorshkov, Z.-X. Gong,
  Probing ground-state phase transitions through quench dynamics,
  (2018) arXiv:1809.06377 [quant-ph], (submitting to PRL soon).

Internship Experience

Department of Energy, Office of Nuclear Energy ***MD; Jan 2016***

- Shadowed the Director of Space and Defense Power Systems, learning about the DOE's task of ensuring containment of nuclear material during NASA launches with Radioisotope Power Systems onboard.
- Used HTML/CSS to design a website that presents information on the department to the public.

Projects and Skills

NISQAI (Noisy Intermediate-Scale Quantum Artificial Intelligence)

- Three graduate students and I won a $2000 grant called the Unitary Fund (from Will Zeng, Rigetti) for our proposal to develop an open source platform in Python and MATLAB to facilitate the study of quantum neural net implementations and other machine learning techniques on near-term quantum hardware. To see our current progress, see github.com/QuantumAI-lib/NISQAI. We began this project in September 2018.

C++ Quantum Computer Simulator

- I implemented a quantum computer simulator (github.com/jiosue/Quantum-Computer-Simulator-with-Algorithms), and used it to implement various algorithms, such as the quantum and inverse quantum Fourier transform, Grover's search method, addition, modular addition, quantum period finding, and Shor's factorization method.

IBM (qiskit) and Rigetti (pyquil/forest) quantum computing frameworks

- I worked extensively with IBM and Rigetti's quantum computer simulators during my time at Los Alamos National Laboratory and implemented many algorithms on their quantum processors.

Android Development (Java)

- I have an application on the Google Play Store called *Distance to Green* under developer name "Eigenjoe". The application is free, but I included monetized banner advertisements using AdMob.

Other

- Python, Mathematica, MATLAB, LaTeX, C, Julia, ROOT.

Teaching and Misc Work

Teaching Assistant and Grader ***MA; Aug 2016 – Dec 2016***

- TA for freshman level physics II, electricity and magnetism. I was responsible for tutoring and grading twenty students. Approximately 13 hours a week during the semester.
- Referred to as “best TA ever” by several students in anonymous subject evaluations.

Intramural Ice Hockey Referee and Skate Guard ***MA; Jan 2016 – Present***