Edison M. Murairi

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Education

George Washington University (GWU)
Physics, Ph.D. *Sept. 2020 - May 2024*
GPA: 3.95/4.00
Thesis title: Simulating Gauge Theories on Quantum Computers
Relevant courses: Quantum computing, Quantum Chromodynamics, Advanced Quantum Mechanics, Quantum Mechanics, Advanced Mathematical Methods, Computational Methods

George Washington University (GWU)
Data Science, Graduate Certificate *Jan. 2022 - Dec. 2023*
GPA: 4.00/4.00
Relevant courses: Time Series Models and Analysis, Deep Learning and Data Mining

New York University Abu Dhabi
Bachelor of Science, Physics *Sept. 2016 - May 2020*
GPA: 3.70/4.00
Capstone Project: Cosmic Ray Production of Supernova Remnant Kes 17

Work experience

George Washington University *May 2021 - Present*
PhD Research Assistant *Washington DC, USA*

- Developed the best known quantum algorithm for simultaneous diagonalization of Pauli operators
- Extended the algorithm to arbitrary hardware connectivity and showed that the algorithm outperformed previously known results
- Developed an asymptotically optimal quantum algorithm in CNOT count for Hamiltonian simulation on near-term quantum computers
- Established a lower bound on the CNOT count for a wide class of quantum algorithms
- Benchmarked the algorithm on physical problems and showed that it outperformed previously known results
- Discovered the formulation of boolean function ESOP minimization in terms of graph theory, an important result for minimizing quantum circuits of boolean functions
- Used the new formulation of ESOP minimization to develop a Deep-Learning model to minimize the number of gates needed to compile quantum circuits

Fermi National Accelerator Laboratory (Fermilab) *May 2022 - Present*
PhD Visiting Researcher *Batavia IL, USA*

- Built an approximation algorithm to simplify ESOP boolean functions, an important result for compiling quantum circuits of boolean functions
- Demonstrated that this algorithm reduced the number of T-gates by a factor of 10 when applied to a Gauge theory
- Calculated 'freezing' temperatures in lattice gauge theories of crystal-like subgroups of $SU(3)$
- Implemented an automated pipeline to analyze monte carlo simulations of gauge theories

Quantum Computing Internship for Physics Undergraduates (QCIPU) *2022 & 2023*
Quantum Computing Instructor *Fermilab, Batavia IL, USA*

- Taught quantum computing during the summer school
- Assisted students through programming projects

NYU Tandon School of Engineering *May 2018 - Aug. 2019*
Research Fellow *NY, USA*

- Studied the theory of quantum error-correcting codes
- Studied the AdS/CFT correspondence in term of quantum error-correcting codes
- Selected among 20 other groups to present findings at the Tandon Research Symposium

Awards

Parke Award for Excellence in Theoretical Physics *May 2023*
Recognized for the success in developing quantum algorithms with applications to gauge theories.

NYU Tandon School of Engineering Fellowship *May 2018 - Aug. 2018*
Selected among thousands of applicants to study Quantum Error Correcting Codes and the AdS/CFT correspondence

NYU Abu Dhabi Research Grant *May 2019*
Won the award to conduct research in novel methods for calculating null geodesics in various spacetime geometries

NYU Abu Dhabi Research Grant *May 2019*
Won the award to conduct research in the cosmic ray production of supernova remnants

Talks

Lattice Conference 2023 – Fermilab *July 31st, 2023*
How many quantum gates do gauge theories require?

GWU Nuclear Physics Seminar *Sept. 19th, 2023*
Algorithms for Simulating Gauge Theories on a Quantum Computers

χ-QCD Meeting *Dec. 18th, 2022*
Quantum Simulations of Gauge Theories

Fermilab Quantum Information Science Seminar *Nov. 2022*
How many quantum gates do gauge theories require?

Technical skills

Quantum computing:	Quantum algorithms, Quantum error correction, Quantum machine learning
Mathematical Modeling:	Time series forecasting, Financial Modeling
Programming Languages/Tools	C, C++, Python, R, Mathematica, LaTeX

Language proficiencies

English, French, Swahili

Memberships

American Physical Society (APS)