Gage Erwin

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Education

The University of Tennessee, Knoxville **Expected Graduation: Spring 2024**

Bachelor of Science (B.S.) - Physics and Mathematics, Physics Honors Concentration *GPA: 3.89*

- Sigma Pi Sigma - Honors Physics Society Member(Since May 2023)

Coursework: Quantum Mechanics I/II, Classical Mechanics I/II, Electricity and Magnetism I/II, Thermal Physics, Differential Equations, Partial Differential Equations, Numerical Analysis

Technical Skills

Languages/Database: Python, C++/C# , JavaScript, Root, Matlab
Software & Tools: Linux, Windows, Shell (Bash), LaTeX, Microsoft Office, Git., SolidWorks, Auto Desk Inventor

Undergraduate Thesis

"Exploration of corrugation effect for ^{4}He adsorbed on graphene"; Thesis committee: Dr. Adrian Del Maestro, Dr. Steven Johnston, and Dr. Jim Ostrowski; https://delmaestro.org/adrian/people.html. Presented August 25, 2023

Research Experience

Department Faculty Research **August 2022 – Current**

Undergraduate Researcher, Mentor: Dr. Adrian Del Maestro *University of Tennessee, Knoxville*

- **Theoretical quantum materials research**, understanding the microscopic effects of corrugation on adsorbed quantum phases of matter.
- Derived an *ab initio* potential to describe interactions between ^{4}He atoms and graphene.
- Resolved errors in path integral Monte Carlo code and added new functions for varying corrugations in relation to Honors Undergraduate Thesis project at UTK.
- Explore exotic phases of matter in the low-dimensional regime funded by the NSF Materials Research Science and Engineering Award at UTK.

Quantum Algorithm Optimization REU **June 2023 - August 2023**

Undergraduate Researcher, Mentor: Dr. Jim Ostrowski *University of Tennessee, Knoxville*

- Developed and implemented a Quantum Approximate Optimization Algorithm (QAOA) to address Non-deterministic polynomial time complete graph isomorphism problems.
- Conducted comprehensive research analyzing the algorithm's performance on a diverse range of graphs.
- Designed a neural network to identify graphical structures by interpreting QAOA outputs, establishing a bridge between quantum results and graph information, particularly at low depth.

National High Magnetic Field Laboratory REU **June 2022 - August 2022**

Undergraduate Researcher, Mentor: Dr. Kaya Wei *Tallahassee, Florida*

- Collaborated at the National High Magnetic Field Laboratory to study thermoelectric materials and crystal growth methodologies.
- Explored compositions within the 1-6-6 lanthanide series to investigate the possibility of a "Phonon-glass electron-crystal" that would exhibit structures to reduce thermal conductivity and electrical resistance.
- Gained proficiency in proper personal protective equipment (PPE) and adhering to laboratory safety protocols.
- Characterized samples using powder X-ray diffraction, single-crystal X-ray diffraction, energy dispersive spectroscopy, and physical property measurement system with a thermal transport attachment.

Departmental Research Assistantship **February 2022 - May 2022**

Undergraduate Researcher, Mentor: Dr. Siopsis *University of Tennessee, Knoxville*

- Researched theoretical Quantum Computing and deriving different qubit sized circuits.
- Read through "Quantum Computer Science, An introduction" by M. David Mermin
- Linked group theory to Quantum Mechanics to understand Shor's Algorithm

Oklahoma State University REU **June 2021 – August 2021**

Undergraduate researcher Mentor: Dr. Alexander Khanov *Oklahoma State University*

- Experimental high energy particle physics, learning a broad range of topics such as the fundamentals of particle physics and SUSY.
- Used Root/C++ to extrapolate b-tagging techniques used on top-anti-top quark pairs to ZH samples, possible long-lived particle samples, to identify possible improvements to prexisting algorithms to better identify long-lived particles.
- Used Kinematic and Geometric properties to determine the differences between low level and high level algorithms and suggested improvements for identifying bottom-jets that originated far from the beam interaction point.

Publications

- **Erwin, G.**, Del Maestro, A. *Effects of substrate corrugation during helium adsorption on graphene in the grand canonical ensemble*, arXiv:2311.12747, submitted to Journal of Low Temperature Physics

Selected Presentations

- **Erwin, G.**, Del Maestro, A. (2023) "Corrugation effects on the second ^{4}He adsorbed layer on graphene." (90th Annual Meeting of the Southeastern Section of the APS: https://meetings.aps.org/Meeting/SES23/Session/N03.4. Talk given November 11, 2023.
- **Erwin, G.**, Del Maestro, A. (2023) "Helium Adsorption: Does a Corrugated Potential Matter?." (University of Tennessee, Knoxville, Discovery Day 2022 : https://symposium.foragerone.com/discovery-day-2023/presentations/59140). Presented September 2023.
- **Erwin, G.**, Ostrowski, J. (2023) "Predicting Graph Structure from QAOA Output." (UTK Summer Research Scholars Symposium 2023 : https://symposium.foragerone.com/utk-summer-research-scholars-symposium-2023/presentations/58320). Presented July 2023.
- **Erwin, G.**, Siopsis, G. (2022) "Quantum Cryptography against NSA Encryption." (Society of Physics Students Zone 8 Conference Talk). Presented February 2023
- **Erwin, G.**, Siopsis, G. (2022) "Quantum Cryptography against NSA Encryption." (University of Tennessee, Knoxville, Discovery Day 2022 : https://symposium.foragerone.com/discovery-day-2022/presentations/48822). Presented September 2022.
- **Erwin, G.**, Wei, K. (2022) "Thermoelectric Properties of Kagome Metals." (Nation High Magnetic Laboratory Summer Presentation: https://nationalmaglab.org/education/college-students/reu/). Presented July 2022.
- **Erwin, G.**, Khanov, A., Goswami, S. (2021) "Foundation of b-tagging applied to long-lived particles." (88th Annual Meeting of the Southeastern Section of the APS: https://meetings.aps.org/Meeting/SES21/Session/H01.40). Presented November 2021.
- **Erwin, G.**, Khanov, A., Goswami, S. (2021) "Foundation of b-tagging applied to long-lived particles." (Oklahoma State University 2021 Undergraduate Summer Research Expo: https://hdl.handle.net/11244/330162). Presented July 2021

Fellowships and Awards

- Robert Talley Award For Outstanding Undergraduate Research; "excelled in his research role, diving into details, showing real ambition, motivation, and an ability to self-direct towards results." - Adrian Del Maestro; May 2023
- J. P. and Gladys Maples Award; Presented to a Junior to encourage scholastic excellence; April 2023
- Dr. Glenn & Elise Young Award; Given to Mathematics and Physics majors who have demonstrated successful academic performance; April 2022
- Robert Blanton Ellenburg Award; Given to incoming freshmen engineering students with exceptional scores; August 2020

Certifications

Certificate 1: Qiskit Global Summer School 2023 - Quantum Excellence

Outreach and Leadership

- Society of Physics Students, President; 2023 - 2024
- Society of Physics Students, Vice President; 2022 - 2023
- Society of Physics Students, Treasurer; 2021 - 2022
- Physics Department Tutor; August 2022 - May 2023
- Camp TESLA; July 12, 2022
- Godby High Summer Program; June 16, 2022
- STEM Young Professionals Panel; June 22, 2022