Emily Foley

PhD Student, University of Arizona
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Education

University of Arizona — Tucson, AZ
Doctor of Philosophy, Applied Mathematics — *Aug 2024 – Present*

Wake Forest University — Winston-Salem, NC
Bachelor of Science, Physics and Mathematics — *Aug 2020 – Jun 2024*
Magna cum laude, Phi Beta Kappa
GPA: 3.93/4.00

Research Experience

Mentored Graduate Research Study — University of Arizona
Project: Simulating Magnetic Field States of Black Holes — *Sept 2024-Present*
Advisor: Chi-Kwan Chan

- Using ATHENAK, an advnaced numerical general relativistic magnetohydrodynamics library in C++, to simulate accretion disks of magnetically arrested black holes on GPU architectures
- Running simulations on the University of Arizona HPC with SLURM scripts

Undergraduate Thesis, Physics — Wake Forest University
Project: Investigating the Unruh State in 4D Schwarzschild-de Sitter Space — *2022 - 2024*
Advisor: Paul Anderson

- Analytically and numerically investigated quantum effects of black holes related to the Hawking Effect, focusing on Boulware and Unruh vacuum states in the cosmological region
- Numerically computed scattering states of Unruh radiation from black holes and compared their behavior to radiation emitted from the cosmological horizon

Undergraduate Thesis, Mathematics — Wake Forest University
Project: Spatiotemporal Chaos in the Damped-Driven Sine Gordon Equation — *Sept 2023- Apr 2024*
Advisor: John Gemmer

- Numerically characterized solutions to the damped and forced sine-Gordon equation, searching for spatiotemporal chaos
- Determined regions in parameter space in which solutions exhibit aperiodic late time behavior using numerical simulations in MATLAB

DOE Summer Undergraduate Laboratory Internship (SULI) — Los Alamos National Lab
Project: Space Charge Calibration the ProtoDUNE Cryostat using a UV Laser System — *May 2023 - Jul 2023*
Advisor: Sowjanya Gollapinni

- Developed an extensive analysis framework in python to correct electric field distortions in the detector for a prototype for the Deep Underground Neutrino Experiment (DUNE)
- Generated electric field correction maps using delaunay triangulation to map over 1 million Monte Carlo-simulated space charge distortions to simulated laser tracks

Research Experience for Undergraduates (NSF-REU) — University of Minnesota
Project: Updated Multimessenger Implications for Forthcoming LIGO Observing Runs — *Jun 2022 – Aug 2022*
Advisor: Michael Coughlin

- Conducted approximately 10,000 Monte Carlo simulations of gravitational wave signals to predict detection rates and sensitivity constraints for the next observation run of the LIGO detector network
- Simulated 3000 light curves using Monte Carlo radiative transfer code
- Results were used to inform data-driven proposals by the scientific community to detect electromagnetic counterparts to gravitational wave signals

Funding, Awards, and Honors

DOE Computational Science Graduate Fellowship — Krell Institute
Awarded 4 years of financial support for graduate studies. 633 applications, 30 awards offered — *2025-*

University Fellows Award — University of Arizona
Awarded to highest ranked incoming graduate students at the University of Arizona to fund the first year of graduate studies — *Aug 2024-*

William E. Speas Award — Wake Forest University
Awarded for distinguished undergraduate work in Physics — *May 2024*

Outstanding Undergraduate Oral Presentation — American Physical Society
One of nine out of 100+ undergraduates recognized for an outstanding presentation at the 2023 APS April Meeting — *Apr 2023*

2023 Barry Goldwater Scholarship Nominee — Wake Forest University
One of four students nominated by Wake Forest University to be considered for the 2023 Barry Goldwater Scholarship — *Dec 2022*

Stamps Scholarship — Stamps Foundation
One of 267 students selected from a competitive pool of 250,000+ applicants for the Stamps Scholarship to fully fund undergraduate studies — *Aug 2020 - May 2024*

Joint Math Meetings Travel Funding — American Mathematical Society
Awarded to attend Joint Math Meetings — *Jan 2024*

1976 Mathematics Faculty Legacy Fund — Wake Forest University
Awarded to attend Joint Math Meetings — *Jan 2024*

Starr Travel Grant — Wake Forest University
Awarded to attend APS April Meeting — *Apr 2023*

Publications

Kiendrebeogo, R. W., Farah, A. M., **Foley, E. M.**, Gray, A., Kunert, N., Puecher, A., ... & Ahumada, T. "Updated Observing Scenarios and Multimessenger Implications for the International Gravitational-wave Networks O4 and O5." The Astrophysical Journal 958.2 (2023): 158. DOI: 10.3847/1538-4357/acfcb1

Presentations

Investigating the Unruh State in 4D Schwarzschild-de Sitter Spacetime — Winston-Salem, NC
Seminar presentation of honors thesis research to 50+ physics faculty members and students at Wake Forest University — *Apr 2024*

Noise Induced Tipping in the Forced Sine Gordon Equation — San Francisco, CA
Oral Presentation at Joint Math Meetings, 20+ attendees — *Jan 2024*

Solutions to Mode Equations in 4D Schwarzschild-de Sitter Spacetime — Minneapolis, MN
Oral Presentation at American Physical Society April Meeting, 20+ attendees — *Apr 2023*

Updated Observing Scenarios Based on LIGO Public Alerts Data — Winston-Salem, NC
Seminar presentation to physics department faculty and students at WFU, 50+ attendees — *Aug 2022*

Updated Observing Scenarios Based on LIGO Public Alerts Data — Minneapolis, MN
Poster and oral presentation at REU Research symposium, 200+ attendees — *Aug 2022*

Updated Observing Scenarios Based on LIGO Public Alerts Data — Minneapolis, MN
Oral presentation given at the Zwicky Transient facility summer school workshop, 60+ attendees — *Jul 2022*

Conferences and Workshops Attended

Algorithms For Multiphysics Models In The Post-Moore's Law Era — Los Alamos, NM
Wokshop at Los Alamos National Laboratory — *June 2025*

IGM Roundtable Hackathon — Tucson, AZ
Conference at University of Arizona — *Feb 2025*

Arizona-Los Alamos Days — Tucson, AZ
Workshop at University of Arizona — *Oct 2024*

CUWiP Conference — Clemson, SC
APS sponsored conference for undergraduate women in physics — *Jan 2024*

Languages and Software

Python, MATLAB, C++, Mathematica, HTML/CSS, Linux/Unix systems, bash, SLURM scripting, LaTeX

Service and Employment

Association of Women in Mathematics (AWM) — Wake Forest University
Vice President: Apr 2023 - May 2024
Secretary: Apr 2022- Apr 2023

- Published weekly newsletter to the mathematics and statistics faculty, staff, and students
- Planned weekly events to foster an inclusive and welcoming community among mathematics and statistics students at Wake Forest University.

Integrating Research in Science (IRIS) Conference Organizer — Wake Forest University
Lead Organizer: Jan 2024 - Apr 2024
Assistant Organizer: Jan 2021 - Apr 2023

- Planned a semiannual undergraduate STEM research conference with 70+ attendees in collaboration with undergraduate students at Wake Forest University and Elon University.

Mathematics Tutor — Wake Forest University
Math and Stats Center — *Mar 2022 - Jan 2024*

- Tutored 50+ undergraduate students for 2-4 hours weekly in the calculus sequence, linear algebra, ordinary differential equations, and complex analysis.