

EDUCATION	<p>Princeton University Ph.D. in Physics, Research Advisor(s):</p> <p><i>as an NSF Graduate Research Fellow</i> <i>TBD</i></p> <p>University of Pennsylvania Master of Science in Physics, Bachelor of Arts in Physics, Minor in Mathematics, Research Advisor:</p> <p><i>concentrating in Astrophysics</i> <i>James M. Kikkawa</i></p>	<p><i>August 2023 - Present</i></p> <p><i>August 2019 - May 2023</i></p>
RESEARCH INTERESTS	<p>I am interested in theoretical formulations of Quantum Gravity that explain phenomena near black hole event horizons during the processes of black hole creation, entropy flow, Hawking radiation, and black hole evaporation: specifically, the possibility of an AdS/CFT correspondence known as holographic entanglement. My current research focuses on optical field theory, in particular the decomposition and isolation of Laguerre-Gaussian modes with quantized orbital angular momentum. My previous research focused on modeling plasma field flow in the Saturnian magnetosphere.</p>	
RESEARCH SUMMARY	<p>Student Researcher with Prof. James Kikkawa UPenn Department of Physics and Astronomy</p> <ul style="list-style-type: none"> • Developed a novel technique for generating beams of light with stable phase singularities, thus carrying consistent and focused quantized orbital angular momentum. This is highly desirable in the fields of atomic physics, high speed data transmission, and quantum computing. • Modeled the optical field diffraction of a grating with arbitrary transmission and retardance, and refraction through a lens with arbitrary focal length, using C++ code I developed. • Explored signal analysis techniques making use of multi-dimensional singular value decomposition. <p>College Intern with Dr. George Clark, Dr. Peter Kollmann Johns Hopkins University Applied Physics Lab</p> <ul style="list-style-type: none"> • Modeled plasma loss processes in Saturnian magnetosphere using Python code I constructed, with initial conditions drawn from measured Cassini CHEMS data. • Showed using this model that charge exchange is the dominant loss process for hydrogen ions and water group ions near Saturn in the keV range. 	<p><i>May 2021 - Present</i></p> <p><i>June 2018 - January 2022</i></p>
PUBLICATIONS & PREPRINTS	<p>[2] Andrew Sontag, Mehmet A. Noyan, and James M. Kikkawa, <i>High purity orbital angular momentum of light</i>, <i>Optics Express</i> 30, 24 (2022).</p> <p>[1] Andrew Sontag, George Clark, and Peter Kollmann, <i>Charge exchange ion losses in Saturn's magnetosphere</i>, <i>Journal of Geophysical Research: Space Physics</i> 126, 10 (2021).</p>	
PRESENTATIONS & CONFERENCES	<p>[3] <i>Charge Exchange Ion Losses in Saturn's Magnetosphere</i> American Geophysical Union Fall Meeting, New Orleans, LA, 15 December 2021.</p> <p>[2] <i>Orbital Angular Momentum: Huygens-Fresnel GPU Simulation</i> University of Pennsylvania Interdisciplinary Group Meeting, Philadelphia, PA, 22 October 2021.</p> <p>[1] <i>Charge Exchange Ion Losses in Saturn's Magnetosphere</i> Outer Planets Assessment Group, (Remote), 31 August 2021.</p>	

TEACHING
EXPERIENCE

Teaching Assistant, Mathematics

University of Pennsylvania Department of Mathematics

August 2021 - Present

- Spring 2023: Math 114 – Multivariable Calculus
- Fall 2022: Math 104 – Introductory Calculus
- Spring 2022: Math 104 – Introductory Calculus
- Fall 2021: Math 104 – Introductory Calculus

Tutor, Physics and Mathematics

August 2020 - Present

- UPenn Engineering Math 251 – Analytical Methods
- UPenn Engineering Math 240 – Differential Equations
- UPenn Math 104, 114, 240, 241 – Calculus Series
- UPenn Physics 150, 151 – Mechanics and Electromagnetism
- AP Physics I, II, C: Mechanics, C: Electromagnetism

SELECT
AWARDS

National Science Foundation Graduate Research Fellowship

April 2023

- One of 2254 graduate students (175 in physics and astronomy) in the United States selected from a pool of over 13000 students to receive an NSF GRFP Fellowship, on the basis of: “excellent intellectual merit and broader impacts.”
- “The NSF GRFP recognizes and supports outstanding graduate students in STEM disciplines who are pursuing research-based doctoral degrees at accredited US institutions.” ([citation](#))

Roy and Diana Vagelos Science Challenge Award

July 2022

- One of 7 students in the Penn STEM program, only 2 of whom are physics majors, to receive a scholarship fully covering all tuition and expenses at Penn until graduation, independent of financial need.
- The goal of the scholarship is “to reward the very best, motivated and advanced science students, and challenge them to get the most from themselves and Penn” ([citation](#))

Goldwater Scholarship

March 2022

- One of 417 students (43 physics majors) in the United States selected from a pool of over 5000 students to receive a Goldwater Scholarship, on the basis of: “strong commitment to a research career in the natural sciences, mathematics, and engineering, effective display of intellectual intensity, and potential for a significant future contribution to research in his/her chosen field.”
- “The Goldwater Scholarship Program seeks to identify and support college sophomores and juniors who show exceptional promise of becoming this Nation’s next generation of research leaders in the natural sciences, engineering and mathematics.” ([citation](#))

COMPUTER
SKILLS

I have extensive programming experience in **Python**, including computations and data analysis with NumPy, SciPy, and AstroPy, as well as data visualization with Matplotlib. Additionally, I can write and run optimized code for graphic processors in **C++** using the CUDA package. I am also fluent in **Mathematica** and **MATLAB**. I am proficient in **L^AT_EX**, and I can create figures with TikZ. I have a working knowledge of **HTML** and **CSS**.

SELECT
GRADUATE
COURSEWORK

In Progress

- Self-study of Becker-Becker-Schwarz *String Theory and M-Theory*
- Self-study of Polchinski *String Theory* Volumes I, II

Completed

- Quantum Field Theory I, II
- Mathematical Foundations of Theoretical Physics I, II
- Statistical Mechanics
- Quantum Mechanics I, II
- Particle Physics
- General Relativity
- Differential Geometry