Shane O'Brien

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Professional Summary

Physics graduate with a strong foundation in experimental particle physics, astrophysics, data analysis, and programming. Experienced in utilizing Python, ROOT, and MadGraph to analyze simulated particle collision data, as well as applying Markov-Chain Monte-Carlo algorithms in astrophysical research. Skilled in working with Linux-based systems for high-performance computing and Python for data visualization. Seeking a graduate program to further develop my skills and collaborate on research with leading experts in the field of experimental particle physics.

Education

B.S. in Physics, with Honors - UC Irvine (Sep. 2020 – June 2024)

- Specialization in Astrophysics
- Dean's Honor List (5 Quarters)
- Honor's Senior Thesis: "A Characterization of TOI-5916b for the Greater GEMS Survey", under Prof. Paul Robertson

Honors and Awards

- **Outstanding Graduating Senior Research Award ($500)** - UC Irvine, 2024
  - For leading a paper with the GEMS Collaboration, to be submitted to the Astrophysical Journal
  - Awarded to only one or two graduating seniors
- **Resonance Fellow** - UC Irvine, 2024
  - Recognition for serving as an undergraduate peer mentor
- **Resonance Fellow** - UC Irvine, 2023
  - Recognition for serving as an undergraduate peer mentor
- **Dean's Honor List** (5 Quarters) - UC Irvine, 2022, 2023, 2024
  - For outstanding academic achievement in the given quarter: finishing the quarter with a 3.5 GPA or above
- **Rank of Eagle Scout** - Boy Scouts of America, 2020
  - The highest rank possible in the Boy Scouts, only awarded to about 4% of scouts

Research Experience

Undergraduate Researcher, Astrophysics (Robertson Group) - UC Irvine (Sep. 2023 – Present)

- Working to characterize Giant-Exoplanets around M-Dwarf Stars (GEMS) in order to support a larger collaboration which intends to understand how these exoplanets form
- Utilizing Markov-Chain Monte-Carlo algorithms to analyze data from telescopes such as, TESS, HPF, and other ground based sources
- Using the results from this analysis to characterize a specific system, adding more to the collective knowledge of these GEMS systems, so the planetary formation process can be better understood
- Paper in preliminary stages, to be submitted to APJ

Undergraduate Researcher, Particle Physics (Whiteson Group) - UC Irvine/CERN (May 2023 – Present)

- Lived in Geneva, Switzerland for a month working with the UCI ATLAS collaboration at CERN
- Attended CERN Summer Student lectures where physicists from around the world would come and speak about their work and its relation to experiments at CERN
- Utilizing Python programming, the ROOT framework, and the particle collision simulation program MadGraph to analyze simulated collider data to help improve theoretical understanding of processes

Undergraduate Researcher, Astrophysics (Murgia Group) - UC Irvine (Sep. 2021 – Sep. 2023)

- Investigated the unresolved gamma ray emission excess at the galactic center of the Milky Way by utilizing machine learning to help generate gamma ray maps from gaseous intra-galactic regions for which good data does not exist
- Created Python scripts to take data from simulations and make plots, utilizing the MatPlotLib Python library, to determine if the simulated data was statistically consistent with the observed data in training regions where good data exists

- Regularly conducted and defended my own research at weekly group meetings with involved grad students and the lead professor

Teaching

AP Physics C Instructor, Mechanics & E&M - SCY High School (Part-Time) (Sep. 2024 – Present)
- Instruct AP Physics C, a calculus-based, college-level physics course, at a small private high school part-time
- Plan and deliver three lectures weekly on key physics topics, incorporating problem-solving techniques and real-world applications
- Assign and grade homework and quizzes to assess students' understanding of class material

AP Calculus AB Tutor - San Diego, CA (Part-Time) (Sep. 2024 – Present)
- Working closely with students on a weekly basis in order to guide students on applying problem-solving techniques
- Review homework and practice problems with students to reinforce concepts and ensure comprehension

Physics Learning Assistant - UC Irvine (Sep. 2022 – June 2024)
- Aided professors and TAs for Physics 2 (Intro to Physics), Physics 7C (Intro to Classical Mechanics), Physics 7D (Intro E&M), and Physics 7E (Intro to Waves)
- Collaborated with TAs to guide students through problem-solving and key concepts
- Participated in weekly meetings with professors and TAs to review and improve instructional strategies
- Worked to effectively help students understand the concepts if they encounter any difficulty

Mentoring & Outreach

Physics Dept. Undergraduate Peer Mentor - UC Irvine (Sep. 2022 – June 2024)
- Mentored a "Resonance Group" of new physics students, serving as a peer mentor to new physics majors
- Answered student questions about physics courses at UCI, and helped new students adjust to studying physics at UCI
- Presented my own research to the class of new physics students in order to show them what undergrad research is like and to answer questions about how to get involved in undergraduate research

English Conversation Program (ECP) Facilitator - UC Irvine (Sep. 2021 – Dec. 2021)
- Worked with the UCI International Center to help provide a place where international students could come to practice their conversational English, helping to build their confidence in the language
- Helped provide a judgment free and inclusive environment to international students who may be struggling to meet new people

Technical/Computational Skills

- **Programming Languages**: Python (Advanced), C/C++ (Beginner)
- **Other Computer Languages**: LaTeX, HTML/CSS
- **Data Analysis**: Experience with data processing, fitting models, and interpreting results using statistical tools in Python (e.g., NumPy, SciPy, pandas, matplotlib, Astropy)
- **Scientific Computing**: Knowledge of Monte Carlo simulations and numerical methods
- **Version Control**: Git/GitHub for version control and collaboration on coding projects
- **High-Performance Computing**: Basic understanding of parallel computing and working with computing clusters
- **Software**: Unix/Linux Terminal, ROOT, MadGraph, Mathematica, MS Office, Windows, MacOS

References

- Professor Paul Robertson, paul.robertson@uci.edu - Dept. of Physics & Astronomy, UC Irvine
- Professor Daniel Whiteson, daniel@uci.edu - Dept. of Physics & Astronomy, UC Irvine
- Professor Simona Murgia, smurgia@uci.edu - Dept. of Physics & Astronomy, UC Irvine
- Professor Laura Tucker, tucker@uci.edu - Dept. of Physics & Astronomy, UC Irvine