Gunner Hodges | Ph.D. Student
Astrophysics

Homer L. Dodge Dept. Physics and Astronomy – University of Oklahoma
+1 (870) 688 7731 • gunnerhodges2004@gmail.com

Education

University of Oklahoma **Norman, OK**
Ph.D. *Astrophysics* *Aug 2026 - Present*

Arkansas Tech University **Russellville, AR**
B.S. *Physics,* ***B.S.*** *Mathematics, Summa Cum Laude & Honors College Scholar* *Aug 2022 - May 2026*

Research Experience

Arkansas Tech University, Dept. of Mathematical & Physical Sciences
Physics-Informed Neural Networks and Cosmology *Jan 2026 - May 2026*
Mathematics Capstone Project, Advisor: Dr. Xinli Xiao

Physics-informed neural networks provide a potential alternative to traditional statistical methods for fitting cosmological models and inferencing best-fit parameter values. I trained a PINN assuming ΛCDM cosmology with data from Pantheon+SH0ES supernovae data to reconstruct hubble expansion and determine best-fit cosmological parameters.

Interacting Dark Energy Models and the Cosmic Coincidence Problem *Aug 2025 – May 2026*
Physics Capstone Research Project, Advisor: Dr. Hamed Shojaei

The cosmic coincidence problem stems from the present day densities of dark matter and dark energy in the universe being of the same magnitude. An interacting dark energy model was posed as an alternative to ΛCDM. The model predictions were compared with data from Pantheon+SH0ES supernovae data.

The Ohio State University, College of Arts & Sciences
Improving DESI's Parameter Constraining Power via Redshift Rebinning *May 2025 – Jul 2025*
Undergraduate Research Assistant, Advisors: Dr. Ashley J. Ross, Dr. Klaus Honscheid

Investigated strategies to enhance DESI's parameter-constraining power through rebinning redshift data. Developed Python scripts to adjust binning structures and scale distance measurements and uncertainties. Produced and analyzed Markov Chain Monte Carlo (MCMC) chains to evaluate posterior likelihood contours to quantify enhancements in dark energy constraints and perform statistical analysis.

Leadership & Service

Arkansas Tech University, Dept. of Mathematical & Physical Sciences
Founding Vice President, Sigma Pi Sigma *Dec 2025 - May 2026*
Aided in the foundation of the first $\Sigma\Pi\Sigma$ chapter at Arkansas Tech University. Leading officer responsible for organizing cross-discipline student engagement, outreach, and recruitment.

STEM Ambassador *Jan 2023 - May 2026*
Selected to travel and represent the STEM department to local community schools and encourage enrollment among prospective students.

Instructional & Mentoring Experience

University of Oklahoma **Norman, OK**
Graduate Teaching Assistant *Aug 2023 - Present*

Arkansas Tech University **Russellville, AR**
Teaching Assistant *Aug 2023 – May 2026*

Arkansas Tech University **Russellville, AR**
Math Tutor *Feb 2025 – May 2025*

Arkansas Tech University **Russellville, AR**
Honors College Mentor *Aug 2024 – Dec 2024*
Met with freshman honors students in weekly meetings. Provided guidance on course registration, campus resources, and gave advice for personal and academic success.

North Arkansas College **Harrison, AR**
Math and Science Tutor *Aug 2021 – Jul 2022*

Awards & Scholarships

2022–Present: Arkansas Governor's Distinguished Scholarship
Statewide merit award for ACT $\geq$ 32 or SAT $\geq$1410 and GPA $\geq$3.5

2022-2024: Vann Kerns Memorial Scholarship
Awarded to outstanding students in physics or mathematics maintaining GPA $\geq$3.0 and full-time enrollment

Presentations

May 2026: **Math Senior Capstone, Russellville, AR**
Hodges, G. "Physics-Informed Neural Networks in Cosmology" (Oral Presentation)

April 2026: **ATU Scholars Symposium, Russellville, AR**
Hodges, G. "Interacting Dark Energy Models and the Cosmic Coincidence Problem" (Poster Presentation)

Oct 2025: $\Sigma\Pi\Sigma$ **Physics and Astronomy Congress, Denver, CO**
Hodges, G. "Improving DESI's Parameter Constraining Power via Redshift Rebinning." (Poster Presentation)

Jul 2025: **Ohio State University Summer Undergraduate Research Consortium Symposium**
Hodges, G. "Improving DESI's Parameter Constraining Power via Redshift Rebinning." (Oral & Poster Presentation)

Apr 2025: **ATU Student Research Symposium, Russellville, AR**
Hodges, G., McClain, A. "Analyzing Quantum Mechanical Properties of Electrons via the Anomalous Zeeman Effect to Verify the Bohr Magneton" (Oral Presentation)

Technical Skills

Computational: Python (NumPy, SciPy, Pandas, PyTorch, Matplotlib, COBAYA, GetDist), Jupyter Notebooks, Machine Learning, C++, LaTeX, Git/GitHub, Bash

Professional Memberships

Aug 2024 – Present: American Physical Society (APS), Member

Sep 2025 – Present: Society of Physics Students (SPS), Member

Dec 2025 – Present: Sigma Pi Sigma ($\Sigma\Pi\Sigma$)

References

Dr. Ashley J. Ross
Summer Research Advisor
Research Assistant Professor of Physics, The Ohio State University
Email: ross.1333@osu.edu

Dr. Hamed Shojaei
Undergraduate Research Advisor
Professor of Physics, Physical and Earth Sciences Department Head, Arkansas Tech University
Email: hshojaei@atu.edu