Matthew Hughes

Contact Information

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Department of Astronomy
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Research Interests

Evolution and disruption of star clusters; Galactic stellar streams; multiple populations in globular clusters; numerical and computational methods in scientific computing

Education

Ph.D., Astronomy, Indiana University *Anticipated 2028*
Minor: Scientific Computing
Advisor: Enrico Vesperini

M.A., Astronomy, Indiana University 2026

B.S., Physics, Indiana University 2022
B.S., Astronomy & Astrophysics, Indiana University 2022

Research Experience

Extra-tidal Features of Star Clusters September 2023 - Present
Advisor: Enrico Vesperini
Using the MOCCA (Monte Carlo) and PeTar (direct N-body) simulation codes to model the evolution of tidally limited star clusters. Investigating how extra-tidal features form and evolve over time and analyzing the morphology and kinematics of first- and second-generation stars within these structures.

Post-Baccalaureate Research Assistant January 2023 - August 2023
Advisor: Mike Snow
Redesigned pipe components for liquid helium transport using Autodesk Inventor. Designed coil structure to produce complex magnetic fields using COMSOL Multiphysics simulation software.

Undergraduate Research Assistant October 2021 - December 2022
Advisor: James Musser
Designed an algorithm in C and Root to identify the curvature of a cosmic particle moving through a magnetic field.

Professional Talks

Designing Electromagnetic Coils from Scalar Potentials Fall 2023
Astronomy Seminar, Astronomy Department, Indiana University

Teaching Experience

Instructor of Record, Indiana University Summer 2025

A105 : Stars and Galaxies
A 3-credit online introductory astronomy course for non-science majors with a class size of 30 students. Responsibilities included holding office hours, grading, and updating and editing course material.

Associate Instructor, Indiana University 2023-Present

A100: The Solar System
Instructor of Record: Professor Phyllis Lugger

A107: The Art of Astronomy
Instructor of Record: Professor Liese van Zee

A103: Search for Life in the Universe
Instructor of Record: Professor Zachary Mass

A105: Stars and Galaxies
Instructor of Record: Professor Enrico Vesperini

A221: General Astronomy I
Instructor of Record: Professor Constantine Deliyannis

Public and Community Outreach

Kirkwood Observatory Public Tours, Indiana University Fall 2023-Present
Host evening public observing sessions for the Bloomington, IN community. Give private tours of the observatory for local school and campus groups

Indiana University Science Fest, Indiana University April 2024, October 2024
Volunteered for IU Science Fest at various astronomy themed stations.

Computing Skills

Programming Languages

C/C++, Root, Linux/Unix shell scripting, Python

Software

- AGAMA - galactic dynamics code
- MOCCA - Monte Carlo star cluster simulations
- PeTar - direct N-body integrator
- COMSOL - multiphysics simulation software
- Galpy/Gala - orbit integration Python libraries
- LaTeX - document preparation