Emma Dugan

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Education

2023 – 2025 **Indiana University** – Bloomington, IN
Masters in Astronomy
Minor, Scientific Computing
Mentor: Professor Songhu Wang

Selected coursework

- *Exoplanets and Orbital Dynamics*: Quantitative review of current theoretical models, Observational constraints on the formation and evolution of solar and exoplanetary systems, In-depth introduction to basic dynamical laws, Theories that can be actively applied to a wide range of astrophysical fields.
- *Physical and Observational Cosmology*: Observational basis for current cosmological theory, Early universe evolution, cosmic microwave background radiation, formation of cosmic structure.
- *Galactic Dynamics*: Principles of stellar dynamics, Analytic and computer methods, Applications to the Galaxy and its star clusters.
- *Galaxies*: Properties, evolution, and structure of galaxies and the extragalactic universe.
- *Computational Physics*: Numerical methods for quadrature, Solution of integral and differential equations, Linear algebra, Use of computation and computer graphics to simulate the behavior of complex physical systems.

2019 – 2023 **Michigan State University** – East Lansing, MI
Bachelor's of Science, Astrophysics, Cum Laude
Minor, Mathematics
Mentors: Professor Joey Rodriguez *GPA: 3.922.*

Selected coursework

- *Planets and Telescopes*: Origin and nature of the solar system, planets of the solar system and other star systems, determination of time and celestial coordinates, astronomical instruments, and observational methods.
- *Galaxies and Cosmology*: The Milky Way, structure and content of galaxies, active galaxies and quasars, the expanding universe, and mdern cosmological models.
- *Stars*: Physical processes that determine the structure and evolution of stars, observations of stars and star clusters, and spectra of stars.
- *Methods of Theoretical Physics*: Mathematical methods applied to physical problems in mechanics, electromagnetism, and thermodynamics; multiple integration, vector calculus, Fourier series, ordinary and partial differential equations, eigenvector problems, coordinate transformations, and complex analysis; Newtonian mechanics, rigid body dynamics, heat flow, electrostatics, harmonic motion, and waves.

Honors and Awards

2019-2022 Dean's List (Michigan State University).
Fall 2019, Spring 2020, Fall 2020, Spring 2021, Fall 2021, Spring 2022

2023 Dr. Thomas H. Osgood Award for Outstanding Seniors (Michigan State University)

Research experience

September 2023 – Present **Indiana University**
Mentors: Dr. Songhu Wang (Indiana University)
Using Rossiter-McLaughlin measurements and allesfitter to characterize the obliquity of a sub-Saturn System.

June 2023 – August 2023 **Michigan State University**
Mentors: Dr. Esha Kundu (Michigan State University), Dr. Laura Chomiuk (Michigan State University), Dr. Jay Strader (Michigan State University).
Using data on white dwarfs, black holes, and neutron stars to examine if there is a likely source for fast radio bursts in the local universe.

October 2021 – August 2023

Michigan State Observatory Research Program

Mentors: Dr. Joey Rodriguez (Michigan State University), Dr. Laura Chomiuk (Michigan State University).

Using the Michigan State Observatory to collect light curves for transiting exoplanets, novae, and cataclysmic variables. Learn how to reduce and perform photometry on data collected through the observatory. Assist in helping new observers learn how to run the observatory. 250+ hours working in observatory.

September 2020 – July 2021

National Superconducting Cyclotron Laboratory at MSU

Mentors: Dr. Hendrik Schatz (Michigan State University).

Use python to fit the rates of element production based on data collected at NSCL as well as other laboratories.

Publications

2023

Ejecta Evolution Following a Planned Impact into an Asteroid: The First Five Weeks

Theodore Kareta, Cristina Thomas, Jian-Yang Li, ..., **Emma Dugan**

The Astrophysical Journal Letters.

2023

The multiwavelength view of shocks in the fastest nova V1674 Her

Kirill Sokolovsky, Tyrel Johnson, Sara Buson, ..., **Emma Dugan**

Monthly Notices of the Royal Astronomical Society.

Relevant Experience

February 2024

NASA Lucy Occultation - Polymele – Southwest Research Institute (San Felipe, Baja California, Mexico)

Travel to Mexico and use provided telescopes and equipment to collect data on the asteroid Polymele in an effort to constrain the location, shape, and size of the moon orbiting Polymele.

February 2023

NASA Lucy Occultation - Polymele – Southwest Research Institute (Boulder, CO/Salina, KS)

Travel to Colorado and train with provided telescopes and equipment to collect data on the asteroid Polymele in an effort to constrain the location, shape, and size of the moon orbiting Polymele. Travel to Kansas to collect data.

Summer 2021 **NASA L'SPACE NPWEE Academy** – Arizona State University (Online)
Produced a proposal based on an original idea. Reviewed proposals written by other teams in the academy. Work on a virtual team and attend weekly seminars on how to produce an effective proposal.

Summer 2020 **NASA L'SPACE Mission Concept Academy** – Arizona State University (Online)
Produced a preliminary design review based on the concept of having a secondary payload on the Martian surface. Worked on a virtual team as the team's lead scientist. Attend weekly seminars on how to write a preliminary design review

Technical skills

Programming languages
Proficient in: Python

Software
LaTeX, GitHub, AstroImageJ, DS9, Maxim DL 6, ACE, Sky X

Conferences

July 2024 Poster on TOI-1135b: Sub-Saturns are Universally Misaligned
ERES IX at Cornell University, Ithaca, NY

August 2024 Poster on TOI-1135b: Sub-Saturns are Universally Misaligned
TESS Science Conference III at MIT, Boston, MA

October 2022 Attendee and Member of LOC
GLEAM at IU, Bloomington, IN

July 2023 Poster on Fast Radio Bursts from X-Ray Binary Systems
Mid-SURE at MSU, East Lansing, MI

May 2024 Attendee
Division on Dynamical Astronomy (DDA) at MSU, East Lansing, MI

Teaching experience

Spring 2025 **Associate Instructor, A453: Topics in Astronomy - Exoplanets (Indiana University)**
Host office hours every week to help students with astronomy concepts related to exoplanets. Write up solutions for and grade assignments.

Fall 2024 **Associate Instructor, A103: Search for Life in the Universe (Indiana University)**
Host office hours every week to help students with basic astronomy concepts. Grade weekly assignments.

Summer 2024 **Foundations of Math and Science Instructor, Coding in Python (Indiana University)**
Instruct a two-week course teaching the fundamentals on how to code in Python for middle school and high school age students.

Spring 2024 **Associate Instructor, A107: The Art of Astronomy (Indiana University)**
Host office hours every week to help students with basic astronomy concepts. Grade weekly assignments.

Fall 2023 **Associate Instructor, A105: Stars and Galaxies (Indiana University)**
Host office hours every week to help students with basic astronomy concepts. Grade weekly assignments.

Fall 2022 **Undergraduate Learning Assistant, ISP 205: Visions of the Universe (Michigan State University)**
Host help room hours every week to help students with basic astronomy concepts. Help professor with grading assignments.

Summer 2022 **Undergraduate Learning Assistant, PHY 231C & PHY 232C: Introductory Physics I & II (Michigan State University)**
Host help room hours every week to help students with non-calculus based physics. Topics include Newtonian equations of motion, momentum and energy conservation, rotational motion, gravity, thermodynamics, wave motion, electricity and magnetism, optics, and atomic physics.

Spring 2022 **Undergraduate Learning Assistant, PHY 232C: Introductory Physics II (Michigan State University)**
Host help room hours every week to help students with non-calculus based physics. Topics include electricity and magnetism, optics, and atomic physics.

Fall 2021 **Undergraduate Learning Assistant, PHY 231C: Introductory Physics I (Michigan State University)**
Host help room hours every week to help students with non-calculus based physics. Topics include Newtonian equations of motion, momentum and energy conservation, rotational motion, gravity, thermodynamics, and wave motion.

Volunteer and Public Outreach

September 2023 – Present
Kirkwood Public Nights (Volunteer)
Interact with the public to answer their questions about astronomy and the Kirkwood Observatory. Operate the telescope for the public to look through.

April 2024
Total Solar Eclipse at IU (Volunteer)
Interact with the public to answer their questions about the total solar eclipse and give demonstrations related to the eclipse.

April 2024
ScienceFest at IU (Volunteer)
Interact with the public to answer their questions about astronomy, the upcoming solar eclipse, and Kirkwood Observatory.

March 2024
Monroe County Public Library - Eclipse Event (Volunteer)
Teach young children the basics of an eclipse and provide an activity to demonstrate how an eclipse works.

July 2022 – August 2023
MSU Observatory Public Nights (Volunteer)
Interact with the public to answer their questions about astronomy and the MSU Observatory. Run telescopes for the public to look through.