

PHY 395: Cosmology

Lehigh University, Spring 2023

Instructor: Timm Wrase, Lewis Lab 418, see me in person by email appointment timm.wrase@lehigh.edu (email me any time with questions and feedback!)

Office hours: I am available for meetings after class and Mondays 1-2pm

Class time and place: Tuesday and Thursday 9:20-10:35am, LL 512

Textbook: My typed lecture notes will be available on [CourseSite](#). Optional books are:
“Introduction to Cosmology” by Barbara Ryden (easy)
“An Introduction to Modern Cosmology” by Andrew Liddle (easy)
“Cosmology” by Daniel Baumann (good for reading beyond what we cover)
“Cosmology” by Steven Weinberg (detailed)

General course requirements:

- Read the relevant sections in the lectures notes before or after each class.
- Attend all classes.
- Complete all assignments on time.
- See me if you are having trouble or any questions, concerns or comments about the course!

Overview: This course will provide an introduction to cosmology, i.e., the study of our universe at large scales. In the course you will learn about the evolution of our universe from the Big Bang until today. In particular we will discuss the so-called standard model of cosmology (the Λ CDM model). Special emphasis will be placed on inflation, a period of rapid expansion of the universe shortly after the Big Bang. We will also discuss dark energy, which is the dominating form of energy in the current universe.

Homework: Homework will be assigned each Tuesday and is due the following Tuesday in class. You may work together on the homework, but please make sure that you are able to complete the problems on your own. The work turned in must be your own. You will have two weeks to complete the homework assigned before the two midterms.

Exams: The course will have two midterm exams: one on Thursday 3/2/2023 and one on Thursday 4/6/2023. The final exam date will be decided later in the semester by the registrar’s office. The final will be comprehensive and will consist of three sections.

Grading: The final grades in the course will be based on participation (10%), homework (20%), midterms (20% each) and the final exam (30%).

Initial Competencies: Students should have working knowledge of special relativity, and a basic knowledge of quantum mechanics and multivariate calculus.

Final Competencies:

- Students understand how special and general relativity effect what we observe in the universe today.
- Students will have a working knowledge of the standard model of cosmology.
- Students can explain the evolution of our universe from shortly after the big bang until today.
- Students will demonstrate a basic understanding of dark matter and dark energy.
- Students will have insight into current on-going research in cosmology and understand the big open questions.

Accommodations for Students with Disabilities: Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at indss@lehigh.edu, or online at <https://studentaffairs.lehigh.edu/disabilities>.

The Principles of Our Equitable Community: Lehigh University endorses [The Principles of Our Equitable Community](#). We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.