Extragalactic Astrophysics and Cosmology

Instructor: Hy Trac
Lecture time: MWF 9:30 – 10:20 am
Lecture location: Doherty Hall A301D
Office: 8307 Wean Hall
Phone: 412-268-8351
Email: hytrac@andrew.cmu.edu
Office hours: TBD or by appointment

Textbook

Additional material not covered in the textbook will be provided. Check Blackboard for supplementary documents.

Overview
This advanced undergraduate course will provide an introduction to cosmology (the study of our Universe) and extragalactic astrophysics (the physics of astronomical systems beyond our Galaxy). Looking up at the night sky, have you wondered what is the Universe made of? What is dark matter and dark energy? What is the origin and fate of the Universe? What are the important events in cosmic history? You will explore these and many other interesting questions in this course. The expansion of the Universe and the formation of cosmic structures are two of the most important and fascinating problems in cosmology that you will learn about.

Objectives
You will learn and apply the physical and mathematical formalisms used to describe and model the Universe and extragalactic systems. By the end of the course, you should be able to:

- Formulate problems by applying physical principles
- Solve physical equations analytically
- Solve physical equations numerically using mathematical software
- Visualize quantitative results using plotting software
- Understand some of the scientific discussion in journal articles and seminars
- Understand some of the scientific methods used in modern research
Tentative Schedule

Week 1  Introduction  Chapters 1, 2
Week 2  Space-time  Chapter 3
Week 3  Cosmic dynamics  Chapter 4
Week 4  Cosmological models  Chapter 5
Week 5  Cosmological models  Chapter 5
Week 6  Cosmological parameters  Chapter 6
Week 7  Cosmological parameters  Chapter 6
Week 8  Review, Midterm

Spring break

Week 9  Dark matter  Chapter 7
Week 10  Cosmic microwave background  Chapter 8
Week 11  Nucleosynthesis  Chapter 9
Week 12  Inflation  Chapter 10
Week 13  Structure formation  Chapter 11
Week 14  Structure formation  Chapter 12
Week 15  Review

Assignments
Weekly homework will be assigned on Wednesday and due the following Wednesday in class. Some of the problems will be taken from the textbook. You are encouraged to discuss general problem solving methods with other students, but the solutions you hand in must be uniquely your own. Check Blackboard periodically for assignments and solutions.

Exams
The midterm will be a 50-minute exam during Week 8. The final will be a 3-hour exam following University policies. You may consult some prepared notes for the exams.

Project
TBD

Grading
Class participation  10%
Assignments  20%
Project  20%
Midterm exam  20%
Final exam  30%