



Cosmology

Astro 321
WF 1:30-3:00 AAC 123
First Meeting: 1/5

This course will have its focus on the inhomogeneous universe.

I expect that you are comfortable with programming in your language of choice. Some rudimentary general relativity background would be helpful but not strictly necessary.

There is no required textbook for the course but here are a few suggestions:

- Peacock: Cosmological Physics, Cambridge 1999 (a broad book)
- Dodelson: Modern Cosmology (CMB, kinetic theory)
- Kolb & Turner: Early Universe (early universe)
- Liddle & Lyth: Cosmological Inflation and Large-Scale Structure (inflationary perturbation theory),
- Padmanabhan: Structure Formation in the Universe (non-linear collapse)

In the syllabus below, I give a cross reference to Peacock's book for further reading.

Requirements

There will be weekly problem sets (50%) and a final project (50%).

For a final project you may work in groups of 5 (or fewer) people on any of the following

- Particle Mesh N-Body Code
- Inflationary Perturbation Solver
- Einstein-Boltzmann Code
- Halo Model Code
- Monte Carlo Markov Chain

You may also come up with your own comparable numerical project or be creative and develop a webApp or iApp. If you are truly computation averse see me for permission to do a reading project.

You will present your project to the class at the end of the quarter and submit the PDF of the presentation for linkage here. Extra credit if you make your code publically available.

Problem Sets

- [Problem Set 1](#): Due Jan 14

Syllabus

Rough outline of the course:

- Friedmann Robertson Walker (FRW) Cosmology: P-Ch-3 & 5
- Matter in the Universe: P-Ch-12

- Kinetic theory in an expanding universe: P-Ch-15.1-15.6; P-Ch-16.1-16.3; Dodelson
- Inhomogeneous fields and linear perturbation theory: P-Ch-15.1-15.6; P-Ch-16.1-16.3; Dodelson
- Inflationary Cosmology: P-Ch-11; Liddle & Lyth
- Cosmic Microwave Background: P-Ch-18; [online tutorial](#)
- Large Scale Structure: P-Ch-15
- Spherical collapse and mass functions: P-Ch-15.7-8; 16.4; 17.2
- Bias and the halo model: P-Ch-15.7-8; P-Ch-15.7-8; 16.4; 17.2

Lecture Notes

Lecture notes will be posted as we go through the course:

- [FRW Cosmology](#)
- [Thermal History](#)