

Astronomy 873: Cosmology and Structure Formation

Course Objectives

This course is a graduate-level introduction to astrophysical cosmology, with emphasis on the “standard” big bang theory of the universe and, in the latter part of the course, its extension to a more detailed theory (the inflation + cold dark matter + cosmological constant model) that is presently the leading scenario for explaining the origin of structure in the universe. The course is intended to give you the background needed to (a) read the current research literature, (b) get started on research in cosmology if you wish to do so, and (c) understand the current issues and debates in the field.

Course Outline

We will devote roughly half of the course to the description of the large scale, homogeneous universe (Part I below) and half to topics in structure formation (Part II below). The individual topics listed below will occupy 1-3 lectures apiece.

INTRODUCTION: observational and theoretical basis of the standard model

PART I: THE HOMOGENEOUS UNIVERSE

A minimal sketch of general relativity

Homogeneous cosmological models (the Friedmann-Robertson Walker universe)

Thumbnail sketch of cosmic history

The cosmic microwave background

Primordial nucleosynthesis

Horizons and inflation

PART II: THE INHOMOGENEOUS UNIVERSE

Perturbation theory

Spherical collapse

The cold dark matter paradigm

The cosmic expansion history and dark energy

Microwave background fluctuations

Large-scale structure

Galaxy formation

Readings

There is no required textbook, but there are several that will serve as useful references, each with its own strengths and weaknesses. These are:

Ryden, *Introduction to Cosmology*

Kolb and Turner, *The Early Universe*

Padmanabhan, *Structure Formation in the Universe*

Peacock, *Cosmological Physics*

Peebles, *Principles of Physical Cosmology*

I will put my copies of these books on a reserve shelf in the Astronomy Reading Room (McPherson 4042). Please don't remove them from there, as I may need them for preparing lectures.

I will suggest relevant sections from these books as we go along. There will be some additional readings from journal articles.

Assignments and Grading

The course grade will be based 50% on problem sets and 50% on a final exam. Problem sets will be assigned a little less than once a week and should take 4-8 hours to complete.

The course web page is <http://www.astronomy.ohio-state.edu/dhw/A873/a873.html>.