

Introduction to Cosmology

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1 Overview

This course is designed to give students a brief introduction to physical cosmology. Topics to be covered include spacetime geometry, the Friedmann equations, the Λ CDM model, the thermal history of the Universe, the CMB, and inflation. Some suggested references are:

S. Dodelson, *Modern Cosmology*

V. Mukhanov, *Physical Foundations of Cosmology*

S. Weinberg, *Cosmology*

Supplementary references will also be mentioned throughout the course. Lecture notes and other pertinent materials will be posted on the course website, which is under construction.

2 Lecture Schedule and Location

All six one-hour lectures will take place at 2 PM in the TRIUMF theory room located on the second floor of the MOB, unless otherwise noted. The schedule is as follows:

- Lecture 1: Thursday, July 28, 2016
- Lecture 2: Thursday, August 4, 2016
- Lecture 3: Monday, August 8, 2016
- Lecture 4: Thursday, August 18, 2016
- Lecture 5: Tuesday, August 23, 2016 at **2:15 PM**
- Lecture 6: Thursday, August 25, 2016

3 Course Outline

The tentative outline for the lecture series is shown below.

1. The Homogeneous, Isotropic, Expanding Universe
 - Preliminaries: the Cosmological Principle and Hubble's Law
 - Basics of general relativity and the FRW metric
 - Redshift and distances
2. Dynamics of the Expanding Universe
 - Friedmann Equations
 - Λ CDM and the cosmic energy budget
3. Thermal History (I)
 - Timeline of our Universe's thermal history
 - Thermodynamics and statistical mechanics in the expanding Universe
 - Boltzmann equations and departure from equilibrium
 - Application: neutrino decoupling
4. Thermal History (II)
 - Thermal dark matter production
 - Big Bang Nucleosynthesis
 - Overview of baryogenesis mechanisms
5. The Cosmic Microwave Background
 - Last scattering and recombination
 - Fluctuations in the CMB
6. Inflation
 - Horizon, flatness, and monopole problems
 - Overview of inflation
 - Density perturbations