

COSMOLOGY
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Schedule

- Tuesdays and Thursdays 12:30-1:45, Room 425

Grading

- 50% Homework, 50% Final Exam

Course Description

This course covers the basics of modern cosmology (as opposed to "advanced" cosmology, where quantum field theory and general relativity are required). The first half develops the homogeneous and isotropic Big Bang model, the second half studies the generation of primordial fluctuations from inflation and their evolution until today, as they grow into microwave background perturbations, and eventually galaxies. The course is designed for beginning graduate students in Physics, or anybody with undergraduate training in physics.

Course Syllabus

1. Standard Cosmology
 - Homogeneity and Isotropy
 - Expansion of the Universe, Cosmic Acceleration
 - Friedmann-Robertson Walker Model: Distances, Age, Evolution of Densities, Horizons
 - Thermal History: Relics, Big Bang Nucleosynthesis, Cosmic Microwave Background (CMB) Decoupling
2. Inflation
 - Motivation: Initial Conditions
 - Fundamentals

- Generation of density perturbations (in a basic way)

3. Evolution of Fluctuations

- Linear Perturbation Theory: Growth of Fluctuations in Radiation/Matter Era

- Dark Matter, Baryons, Photons, Transfer function

- Statistics: Correlation Functions, Moments, Power Spectrum

- Basics of CMB Primary Anisotropies, Dark Energy

- Large-Scale Structure: Galaxy Clustering, Non-Gaussianity

Required Textbooks

None, lectures notes available on the course website, see cosmo.nyu.edu/roman/courses

Recommended Textbooks

- S. Dodelson, *Modern Cosmology*, 2003, Academic Press
- E.W. Kolb & M.S. Turner, *The Early Universe*, 1990, Addison Wesley
- A.R. Liddle & D.H. Lyth, *The Primordial Density Perturbation*, 2009, CUP
- V. Mukhanov, *Physical Foundations of Cosmology*, 2005, CUP
- T. Padmanabhan, *Structure Formation in the Universe*, 1993, CUP
- J.A. Peacock, *Cosmological Physics*, 1999, Cambridge Univ Press (CUP)
- P.J.E. Peebles, *Principles of Physical Cosmology*, 1993 Princeton Univ. Press
- S. Weinberg, *Cosmology*, 2008 Oxford