

General Relativity and Cosmology - II
Graduate School - Second Semester

Course outline

0. Historical Perspective

- o Cosmologies of ancient and medieval peoples
- o Overview of the genesis of modern cosmology in General Relativity

1. The “standard” cosmological model

- o Cosmological “Principles”
- o The Robertson-Walker metric
- o Measurements of distances, luminosities, angular sizes, etc. in the cosmological context
- o The Friedman models of classical cosmology
- o Observational tests of the Friedman models

2. Early Universe and the Big-Bang Nucleosynthesis

- o Thermodynamics of early universe
- o Thermal history of early universe
- o Boltzmann equation
- o BBN - Neutron and Light element abundance
- o Dark Matter
- o The epoch of “recombination”
- o Fluctuations in the surface of last scattering

3. Inflationary cosmology

- o Puzzles of expansion, flatness, horizon
- o Equation of state for inflation
- o Inflation scenario
- o Fluctuation spectrum emerging from the inflationary epoch

4. Structure Formation

- o Newtonian Perturbation Theory
- o Perturbation (Newtonian) at sub-horizon scale in real universe
- o Relativistic Perturbation Theory
- o Perturbations during inflation
- o Primordial Power Spectrum

References:

1. L. D. Landau & E. M. Lifshitz: Classical Theory of Fields,
2. S. Weinberg: General Relativity and Cosmology,
3. R. d'Inverno: General Relativity,
4. B. F. Schutz: First Course in General Relativity,
5. J. L. Synge: General Theory of Relativity,
6. J. Hartle: General Relativity,
7. Notes on GR which are recent and follow modern notation:
[S. Carroll: General Relativity (available online)]