

PHYSICS 211CR Cosmology and Other Topics

Ali Kaya

Office: Lyman 447

Office hours: T and Th 13:00-15:00

Grading:

5 Homework: 50%

1 take home midterm: 25%

1 take home final: 25%

Main Resources:

V. F. Mukhanov, H. A. Feldman and R. H. Brandenberger,
Theory of cosmological perturbations. Part 1. Classical perturbations. Part 2. Quantum theory of perturbations. Part 3. Extensions,"
Phys. Rept. 215 (1992) 203.

V. Mukhanov
Physical Foundations of Cosmology
Cambridge University Press 2005

D. Baumann
TASI Lectures on Inflation
arXiv:0907.5424

J. M. Maldacena,
Non-Gaussian features of primordial fluctuations in single field inflationary models,
JHEP 0305 (2003) 013, [astro-ph/0210603].

S. Weinberg,
Quantum contributions to cosmological correlations,
Phys. Rev. D 72 (2005) 043514, [hep-th/0506236].

WEEKLY SYLLABUS:

1. WEEK (January 28 and 30):

Lecture1: General info about the course

Lecture2: Big-bang cosmology, drawbacks, inflation and single scalar field models

2. WEEK (February 4 and 6):

Lecture1: More on inflation

Lecture2: Cosmological perturbation theory I (original version)

3. WEEK (February 11 and 13):

Lecture1: Cosmological perturbation theory II (original version)

Lecture2: Cosmological perturbation theory III (original version)

4. WEEK (February 18 and 20):

Lecture1: Brief introduction to quantization of constrained systems I

Lecture2: Brief introduction to quantization of constrained systems II

5. WEEK (February 25 and 27):

Lecture1: Cosmological perturbation theory I (modern version)

Lecture2: Cosmological perturbation theory II (modern version)

6. WEEK (March 3 and 5):

Lecture1: Cosmological perturbation theory III (modern version)

Lecture2: Quantum fields in a FRW background

7. WEEK (March 10 and 12):

Lecture1: The vacuum indeterminacy and particle creation

Lecture2: Bunch-Davies vacuum and scale free cosmological perturbations

8. WEEK (March 16): Spring Break

9. WEEK (March 24 and 26):

Lecture1: In-in (Schwinger-Keldysh) formalism I (operator approach)

Lecture2: In-in (Schwinger-Keldysh) formalism II (operator approach)

10. WEEK (March 31 and April 2):

Lecture1: In-in (Schwinger-Keldysh) formalism III (path integral approach)

Lecture2: $i\epsilon$ prescription in cosmology

11. WEEK (April 7 and 9):

Lecture1: Non-gaussianities and loops I

Lecture2: Non-gaussianities and loops II

12. WEEK (April 14 and 16):

Lecture1: Symmetries and Noether's theorem (global and local)

Lecture2: Cosmological Ward identities I

13. WEEK (April 21 and 23):

Lecture1: Cosmological Ward identities II

Lecture2: Consistency relation for the three point function

14. WEEK (April 28):

Lecture1: Overview and discussion