Astronomy 688 - Spring 2008
Cosmology

Instructor

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Office hours: by appointment
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Schedule

Lectures on Tuesday and Thursday from 12:30pm to 1:45pm
Room CSS 0201

Course Description

The evolution of the Universe from the Big-Bang to the era of stars and galaxies. The course is divided in two main parts. Part I: the linear evolution of the Universe. Part II: the non-linear growth of perturbations and galaxy formation. Part I covers (i) Inflation, (ii) baryogenesis, (iii) thermal history and neutrino decoupling, (iv) nucleosysnthesis, (v) recombination and radiation decoupling, (vi) CMB radiation, (vii) growth of cosmological perturbation, (viii) CMB anisotropies. Part II covers: (i) measuring cosmological parameters, (ii) Large scale structure and galaxy formation.

Textbooks

Required: *"Cosmology"* by Peter Coles and Francesco Lucchin
Recommended: *"Cosmological Inflation and Large-Scale Structure"* by Andrew R. Liddle, David H. Lyth

Course Grading

Homework	25%
Project	15%
Midterm Exam	30%
Final Exam	30%

There will be one in-class Midterm exam and an in-class Final (the dates of the exams are shown below in the "Tentative course outline" section). Class participation is strongly encouraged. Class attendance is required. During the semester I will hand out 4-5 homework. Their due dates will be announced at the time they are assigned. On the due date the students will be expected to turn in their homework in class. Each of you will write a review paper or a web page on a cosmology topic of your choice. At the end of the semester you will give a short presentation.

Letter Grades

85%-100%	A
70%-85%	B
55%-70%	C
40%-55%	D

I may rescale the grades depending on the average class performance. The rescaling can only increase your final grade. According to the class preference the final letter grade may have a finer division. In this case I will assign A^+ if your score is between 100%-95%, A if your score is 95%-90% and A^- if your score is 90%-85%. Analogously for the other letter grades.

Code of Academic Integrity

"The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.studenthonorcouncil.umd.edu/whatis.html."

Tentative Course Outline - *28 lectures & 2 exams*

Part I: Linear Universe - 19 lectures

A. Era of "non-standard" particle physics - *7 lectures*

1 **Tu Jan. 29**: Intro and overview

2 **Th Jan. 31**: Foundations of Cosmology (CL 1.1-1.3 and Ch.3)

3 **Tu Feb. 5**: Friedman-Leimatrie Cosmology, Hubble law, redshift (CL 1.4-1.7, 1.10-1.13 and Ch.2)

4 **Th Feb. 7**: Solutions of Friedman equations

5 **Tu Feb. 12** : Hot Big bang, Planck time, phase transitions

6 **Th Feb. 14**: Inflation (CL Ch.6 and Ch.7)

7 **Tu Feb. 19**: Chaotic inflation and perturbations from inflation (CL 13.6; Liddle Ch.7)

B. Era of "standard" particle physics - *11 lectures*

8 **Th Feb. 21**: Kinetic theory in the expanding universe (CL 8.1-8.5)

9 **Tu Feb. 26**: Thermal history (CL Ch.5)

10 **Th Feb. 28**: Neutrino decoupling, non-baryonic matter (CL 8.2-8.5)

11 **Tu Mar. 4**: Primordial Nucleosynthesis (CL 8.6)

12 **Th Mar. 6**: Matter-radiation equality, recombination and temperature decoupling

13 **Tu Mar. 11** Spectrum of CMB radiation

14 **Th Mar. 13**: Growth of cosmological perturbations (1)

- **Tu Mar. 18**: Spring Break
- **Th Mar. 20**: Spring Break
- **Tu Mar. 25**: *Midterm exam*

15 **Th Mar. 27**: Growth of cosmological perturbations (2)

C. CMB anisotropies - *4 lectures*

16 **Tu Apr. 1**: Growth of cosmological perturbations: relativistic approach (3)

17 **Th Apr. 3**: Growth of cosmological perturbations: relativistic approach (4)

18 **Tu Apr. 8**: CMB anisotropies (1)

19 **Th Apr. 10**: CMB anisotropies (2)

Part II: non-linear Universe (extragalactic astronomy) - 9 lectures

20 **Tu Apr. 15**: CMB: beyond linear theory

21 **Th Apr. 17**: Measuring cosmological parameters

D. Large scale structure and galaxy formation - *7 lectures*

22 **Tu Apr. 22**: Top-hat collapse

23 **Th Apr. 24**: Large scale structure simulations and theory

24 **Tu Apr. 29**: Press-Schechter formalism

25 **Th May 1**: First stars and galaxies

26 **Tu May 6**: Lyman alpha forest and reionization

27 **Th May 8**: Density profile of dark matter halos

28 **Tu May 13**: Unsolved problems

Final exam sometime between May 15-21: Official date is **Tuesday, May 20 (1:30-3:30pm)**