

Astronomy 688 - Spring 2006

“Cosmology”

Instructor

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Office hours: by appointment

Class web page: <http://www.astro.umd.edu/~ricotti/NEWWEB/teaching/ASTR688.html>

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) nucleosynthesis, (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: “*Modern Cosmology*” by Scott Dodelson

Course Grading

Homeworks	25%
Project	25%
Midterm Exam	20%
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 - 5 lectures

1. **Thu Jan. 26:** Foundations of Cosmology
2. **Tu Jan. 31:** Friedman-Leimatrie Cosmology, Hubble law, redshift
3. **Thu Feb. 2:** Inflation
4. **Tu Feb. 7:** Perturbations from inflation
5. **Thu Feb. 9 :** Reheating and Baryogenesis

B. Era of “standard” particle physics - 10 lectures

1. **Tu Feb. 14:** Kinetic theory in the expanding universe
2. **Thu Feb. 16:** Equilibrium thermodynamic, neutrino decoupling, non-baryonic matter
3. **Tu Feb. 21:** Thermal history
4. **Thu Feb. 23:** Primordial Nucleosynthesis
5. **Tu Feb. 28:** CMB part I: spectrum of radiation (1)
6. **Thu Mar. 2:** CMB part I: spectrum of radiation (2)
7. **Tu Mar. 7:** Recombination and decoupling (1)

8. **Thu Mar. 9:** Recombination and decoupling (2)
9. **Tu Mar. 14:** *Midterm exam*
10. **Thu Mar. 16:** Cosmological perturbations part I: non-relativistic limit (1)
11. **Tu Mar. 21:** Spring Break
12. **Thu Mar. 23:** Spring Break
13. **Tu Mar. 28:** Cosmological perturbations part I: non-relativistic limit (2)

C. CMB anisotropies - 4 lectures

1. **Thu Mar. 30:** Cosmological perturbations part II: relativistic treatment (1)
2. **Tu Apr. 4:** Cosmological perturbations part II: relativistic treatment (2)
3. **Thu Apr. 6:** CMB part II: anisotropies (1)
4. **Tu Apr. 11:** CMB part II: anisotropies (2)

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

1. **Thu Apr. 13:** CMB part III: beyond linear theory
2. **Tu Apr. 18:** Measuring cosmological parameters

D. Large scale structure and galaxy formation - 7 lectures

1. **Thu Apr. 20:** Top-hat collapse
2. **Tu Apr. 25:** Large scale structure simulations and theory
3. **Thu Apr. 27:** Press-Schechter formalism
4. **Tu May 2:** First stars and galaxies
5. **Thu May 4:** Lyman alpha forest and reionization
6. **Tu May 9:** Density profile of dark matter halos
7. **Thu May 11:** Unsolved problems

Sometime between May 13-19: Final exam