

Astronomy 622 - Spring 2012

“Cosmology”

Instructor

Prof. Massimo Ricotti

Office: CSS 0213

E-mail: ricotti@astro.umd.edu

Phone: (301) 405 5097

Office hours: by appointment

Class web page: <http://www.astro.umd.edu/~ricotti/NEWWEB/teaching/ASTR622.html>

Schedule

Lectures on Tuesday and Thursday from 2:00pm to 3:15pm

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

Strongly Recommended: “*Cosmology*” by Peter Coles and Francesco Lucchin

I have developed my own lecture notes, but many topics can be found on the recommended book.

Course Grading

Homework	30%
Term Project	20%
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 and attendance are strongly encouraged. 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 term paper on a cosmology topic of your choice. At the end of the semester you will give a short presentation.

Letter Grades

96%-100%	A+
91.5%-96%	A
87.5%-91.5%	A-
83.5%-87.5%	B+
79%-83.5%	B
75%-79%	B-
71%-75%	C+
66.5%-71%	C
62.5%-66.5%	C-
<62.5%	D

I may rescale the grades depending on the average class performance. The rescaling can only increase your final grade.

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>.”

Attendance Policies

Information about the Spring religious holidays, medically necessary absences, and other university’s attendance policies are available at: <http://www.faculty.umd.edu/teach/attendance.html>

Tentative Course Outline - 28 lectures & 2 exams

Part I: Linear Universe - 19 lectures

A. Cosmological Principles and Era of “non-standard” particle physics - 5 lectures

1. **Thu Jan. 26:** Foundations of Cosmology (CL 1.1-1.3 and Ch.3)
2. **Tu Jan. 31:** Friedman-Leimatrie Cosmology, Hubble law, redshift (CL 1.4-1.7, 1.10-1.13 and Ch.2)
3. **Thu Feb. 2:** Inflation (CL Ch.6 and Ch.7)
4. **Tu Feb. 7:** Perturbations from inflation (CL 13.6 D Ch.6)
5. **Thu Feb. 9 :** Reheating and Baryogenesis (CL 7.4)

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

1. **Tu Feb. 14:** Kinetic theory in the expanding universe (CL 8.1-8.5; D 3.1)

2. **Thu Feb. 16:** Equilibrium thermodynamic, neutrino decoupling, non-baryonic matter (CL 8.2-8.5; D 3.4)
3. **Tu Feb. 21:** Thermal history (CL Ch.5)
4. **Thu Feb. 23:** Primordial Nucleosynthesis (CL 8.6; D 3.2)
5. **Tu Feb. 28:** CMB part I: spectrum of radiation (1) (CL 9.5)
6. **Thu Mar. 1:** CMB part I: spectrum of radiation (2)
7. **Tu Mar. 6:** Recombination and decoupling (1) (CL 9.2-9.3)
8. **Thu Mar. 8:** Recombination and decoupling (2)
9. **Tu Mar. 13:** *Midterm exam*
10. **Thu Mar. 15:** Cosmological perturbations part I: non-relativistic limit (1) (CL 10)
11. **Tu Mar. 20:** Spring Break
12. **Thu Mar. 22:** Spring Break
13. **Tu Mar. 27:** Cosmological perturbations part I: non-relativistic limit (2) (CL 11)

C. CMB anisotropies - 4 lectures

1. **Thu Mar. 29:** Cosmological perturbations part II: relativistic treatment (1) (CL 12)
2. **Tu Apr. 3:** Cosmological perturbations part II: relativistic treatment (2) (CL 13)
3. **Thu Apr. 5:** CMB part II: anisotropies (1) (CL 17)
4. **Tu Apr. 10:** CMB part II: anisotropies (2) (CL 17)

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

1. **Thu Apr. 12:** Cosmological Perturbations (CL 13)
2. **Tu Apr. 17:** Inflation (CL 7)
3. **Thu Apr. 19:** Inflation (CL 7)
4. **Tu Apr. 24:** Inflation (CL 7)

D. Large scale structure and galaxy formation - 7 lectures

1. **Thu Apr. 26:** Top-hat collapse (CL 14.5)
2. **Tu May 1:** First stars and galaxies (CL 14.7)
3. **Thu May 3:** Press-Schechter formalism (halo mass function) (CL 14.5)
4. **Tu May 8:** Projects discussion/review
5. **Thu May 10:** Projects discussion/review

Wednesday May 16 at 10:30: Final exam (CSS 0201)