Astronomy 622 - Spring 2018
"Cosmology"

Instructor

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Office hours: by appointment
Textbook: Galaxy Formation and Evolution, Mo, Van den Bosh, White
Class web page: `http://www.astro.umd.edu/~ricotti/NEWWEB/teaching/ASTR622-18.html`

Schedule

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

Recommended:
Galaxy Formation and Evolution
Authors: Houjun Mo, Fan van den Bosch, Simon White
ISBN: 13-978-0521857932

Another book I have used in the past is:
Cosmology
Authors: Peter Coles and Francesco Lucchin

I have developed my own lecture notes, but many topics can be found on the recommended book. I will also post on ELMS pdf files of lecture notes from other published Cosmology course

Course Grading

Homework	35%
Term Project	15%
Midterm Exam	25%
Final Exam	25%

Homework: 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 instead 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.

The homework turned in will be graded and returned to the students with solutions and the solution may be discussed in class. In case of well motivated circumstances a late homework will be accepted, but a penalty (that will be gradually more severe depending on number of days the homework is late) will be applied to the grade. After the solution is published I will not accept a late homework. A missed homework will receive a "zero" grade and there will not be extra credit or dropping of the lowest grade.

I will post the homework assignments, solutions and grades on ELMS.

Term Project: 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.

Exams: The exams will be closed book, but calculators will be allowed. University regulations will apply regarding academic honesty and excused absences.

The midterm and final exams are a major scheduled grading event and is covered by the relevant rules for excused absence. If you are not able to take an exam due to illness or other legitimate reasons, you must make every reasonable attempt to contact me on or before the day of the exam either by email or voice mail. In addition, you must provide documentation detailing the reason for your absence. A self-signed note is insufficient. A make up exam must be taken promptly. I will give at most one make-up exam. If, for whatever reason, the University is officially closed on the day of the exam, the exam will be re-scheduled for the next lecture date.

The final exam will cover all material discussed in this course after the midterm exam.

Letter Grades

97%-100%	A+
94%-97%	A
90%-94%	A-
87%-90%	B+
84%-87%	B
80%-84%	B-
77%-80%	C+
74%-77%	C
70%-74%	C-
60%-70%	D
<60	F

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`."

Course expectations

Attendance: Attendance in class is crucial. A major part of this course will center around in-class discussions. Simply getting hold of the lecture notes will not allow you to be successful in this course. In the event of an emergency where you have to miss class, you must make sure that you complete all of the assigned reading, get hold of any lecture notes, and see me in my office hours.

Preparation: I expect you to be prepared to work. We will be covering some fascinating but challenging concepts - you will understand this material much more easily if you preview the recommended reading material ahead of time, as well as giving it a more careful read after the lecture. You also should review your class notes sometime before the next lecture to make sure everything is clear. I encourage you to ask questions in the lectures or during my office hours.

Study Habits: Study wisely and ask for help if you need it. It is better to keep up with the material on a daily basis than cram the night before the exam. I encourage you to chat about problems with your friends and classmates you will learn a huge amount from trying to explain confusing issues to each other. However, please keep in mind that all graded materials, including class-assignments and home-works, must be your own thoughts in your own words.

Course Evaluation

Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University. Please go directly to the website `https://www.courseevalum.umd.edu` to complete your evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing online, at Testudo, the evaluation reports for the thousands of courses for which 70% or more students submitted their evaluations.

Course Policies

You can find updated information on Course Related Policies at `https://www.ugst.umd.edu/courserelatedpolicies.html`.

Students With Disabilities

Students who would like to request academic accommodations for a disability should notify the professor at the beginning of the semester and should also register with Disability Support Services: `http://www.counseling.umd.edu` (phone: 301.314.7682).

Tentative Course Outline - *28 lectures & 2 exams*

Part I: Linear Universe - 18 lectures

A. Cosmological Principles, Geometry and Dynamics - *7 lectures*

1. **Thu Jan. 25**: Introduction, course overview, cosmological principles
2. **Tu Jan. 30**: Hubble's law, FRW metric, redshift, distances, ages, particle horizon
3. **Thu Feb. 1**: Cosmological Field Equations, Newtonian approach
4. **Tu Feb. 6**: Cosmological Field Equations and their evolution, flat cosmologies
5. **Thu Feb. 8** : Hot Big Bang, singularity, Planck time
6. **Tu Feb. 13**: Problems of standard model
7. **Thu Feb. 15**: Inflation, Reheating and Baryogenesis

B. Thermal History and Linear Growth of Perturbations - *11 lectures*

1. **Tu Feb. 20**: Kinetic theory in the expanding universe
2. **Thu Feb. 22**: Phase transitions, neutrino decoupling, non-baryonic matter (dark matter)
3. **Tu Feb. 27**: Thermal history
4. **Thu Mar. 1**: Big Bang Nucleosynthesis (BBN)
5. **Tu Mar. 6**: Recombination, decoupling and reionization
6. **Thu Mar. 8**: The Cosmic Microwave Background (CMB)
7. **Tu Mar. 13**: Origin of structures during Inflation

   Thu Mar. 15: *Midterm exam*

   Tu Mar. 20: Spring Break

   Thu Mar. 22: Spring Break
8. **Tu Mar. 27**: Gravitational instability in expanding Universe
9. **Thu Mar. 29**: Transfer function and power spectrum of matter perturbation
10. **Tu Apr. 3**: CMB anisotropies
11. **Thu Apr. 5**:CMB anisotropies, continued

Part II: Large Scale Structures and Galaxy Formation - 10 lectures

1. **Tu Apr. 10**: Top-hat collapse, virialization

2. **Thu Apr. 12**: Press-Schechter Theory
3. **Tu Apr. 17**: Cosmological simulations
4. **Thu Apr. 19**: Galaxy formation I
5. **Tu Apr. 24**: Galaxy formation II
6. **Thu Apr. 26**: Galaxy formation III
7. **Tu May 1**: Dark matter and particle physics
8. **Thu May 3**: Hot topics in cosmology
9. **Tu May 8**: Projects presentations/review
10. **Thu May 10**: Projects presentations/review

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