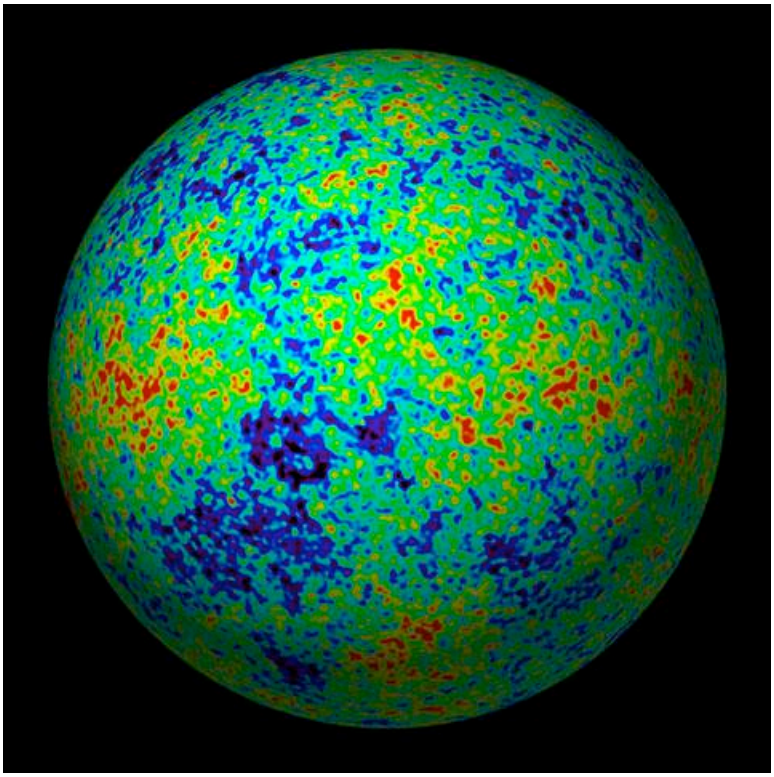
ASTR422 Cosmology
(Spring 2013; Reynolds)



Prof: Chris Reynolds
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Office: CSS 1243
Class schedule : 12.30-1.45pm Tuesdays and Thursdays; room CSS2416.
Office hours:10.30—11.30am Tuesdays, or by appointment
Textbook: "An Introduction to Modern Cosmology" by A.Liddle (2nd Edition)

Course description

The Hot Big Bang theory is one of the most remarkable successes of modern science. Within the framework of this theory, we can understand (in gross terms at least) the evolution of the Universe from a fraction of a second after the Big Bang up to the present time. The Hot Big Bang gives us a framework in which to understand the creation of matter, the formation of the first elements, and the birth of cosmic structure (including galaxies and by extension stars, planets, and us). This course outlines the Hot Big Bang theory, including the recent realization that the Universe is dominated by a mysterious "Dark Energy". It ends with a discussion of the very early Universe and, in particular, the idea for explosion "inflation" in the first instances after the big bang.

Course Pre-requisites

This class is intended for Physics and Astronomy majors, or those with a strong technical background in Physics and Astronomy. A basic knowledge of astrophysics at the ASTR120/121 level will be required, as will a knowledge of physics at the PHYS270/271 (or PHYS273) level. I will assume a good working knowledge of algebra, calculus, differential equations, and Newtonian dynamics.

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.***

Grading

Grades are based on a point scale with different assignments weighted as shown below.

Homeworks (6)	30%
Project paper	20%
Midterm exam	20%
Final exam	30%

Letter grades will be assigned guided by the following scheme.

A	90% - 100%
B	80% - 90%
C	70% - 80%
D	60% - 70%
F	<60%

I may adjust the precise grade boundaries to obtain a fair distribution of final grades.

Midterm exam

There will be one in-class examination on the 14th March 2013. This exam will be closed book, and calculators will be allowed. The exam will consist of essay and problem solving questions. University regulations will apply regarding academic honesty and excused absences (see below).

The midterm exam is 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 you must miss both the midterm and its make-up exam, I will give an oral examination.

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.

Final exam

As per the University rules, the final exam for this course will be held on Thursday 16th May 2013, 1.30-3.30pm, in room CSS2416. The final exam is cumulative in the sense that it will cover all material discussed in this course. The format of the final exam will be the same as the midterm exam, with essay or problem solving questions. Again, the final exam is a "**major scheduled grading event**" and is covered by the relevant rules for excused absence (see above).

Homeworks

The intent is to have a total of six homeworks in this course. On the due date, homeworks should be handed in at the front of the class. Homeworks will be considered late by the end of class. Late homeworks will be accepted for a week after the due-date and will be subjected to a penalty of up to 30%. If you cannot make it to class when homework is due, you should either ask a friend/classmate to hand it in for you, or make sure that it gets to me (room CSS1243) **before** the time that it is due. If you have a valid emergency that prevents you from making a homework deadline, you should make all reasonable efforts to contact me before the due date telling me the nature of the emergency. Please document all such emergencies; *a self-signed note is sufficient provided that it contains a statement that (1) the information is true and correct and (2) providing false information is prohibited under the Code of Student Conduct.*

If, for whatever reason, the University is officially closed on the day of the due date, the due date will be moved to the next lecture.

Project and presentations

A significant component (20%) of the grade for this class will based on a project paper. Detailed about this project will be announced later in the semester.

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

Please note that these rules apply to homeworks and quizzes as well as exams. As a part of these rules, you must give credit to any book (including the course textbook!), published article or web-page that you have used to help you with a particular assignment. The University takes these issues extremely seriously, as do I.

To underscore the need for academic integrity, the University asks you to write the following pledge on any assignment or exam:

"*I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination*."

Preliminary course outline

DATE	PRELIMINARY TOPIC	CHAPTER
	Cosmological basics	
1/24/2013	Introduction; The Cosmological Principle	1,2
1/29/2013	Basic equations of cosmology I	3,4,5
1/31/2013	Basic equations of cosmology II	3,4,5
2/5/2013	General Relativistic cosmology I	AT1
2/7/2013	General Relativistic cosmology II	AT1
2/12/2013	Simple cosmological models	3
	Taking stock of our Universe	
2/14/2013	Taking inventory of the Universe; Dark Matter	6,9
2/19/2013	What is Dark Matter?	8
2/21/2013	The age of the Universe	AT2
2/26/2013	Photon propagation in FRW metric and "distance"	-
2/28/2013	Dark Energy I	7
3/5/2013	Dark Energy II	7
3/7/2013	Special topic	
3/12/2013	*REVIEW*	
3/14/2013	*MIDTERM***	
3/19-21/2013	SPRING BREAK!	
	The hot big bang theory	
3/26/2013	The Cosmic Microwave Background	10
3/28/2013	The hot big bang and thermal history of the Universe	11
4/2/2013	The hadron and lepton eras	12
4/4/2013	Primordial nucleosynthesis	AT5
	Formation of structure	
4/9/2013	Basics of structure formation I	-
4/11/2013	Basics of structure formation II	-
4/16/2013	Feedback in galaxy formation	13
4/18/2013	AGN Feedback	13
	Inflationary cosmology	
4/23/2013	Problems with the standard Big Bang Model	-
4/25/2013	*Inflation*	
4/30/2013	Special topic	
5/2/2013	Special topic	
	Conclusion	
5/7/2013	Wrap-up : The concordance model of cosmology	15
5/9/2013	Speculative ideas	

5/16/2013 FINAL EXAM (1.30-3.30pm)**

** = MAJOR SCHEDULED GRADING EVENT