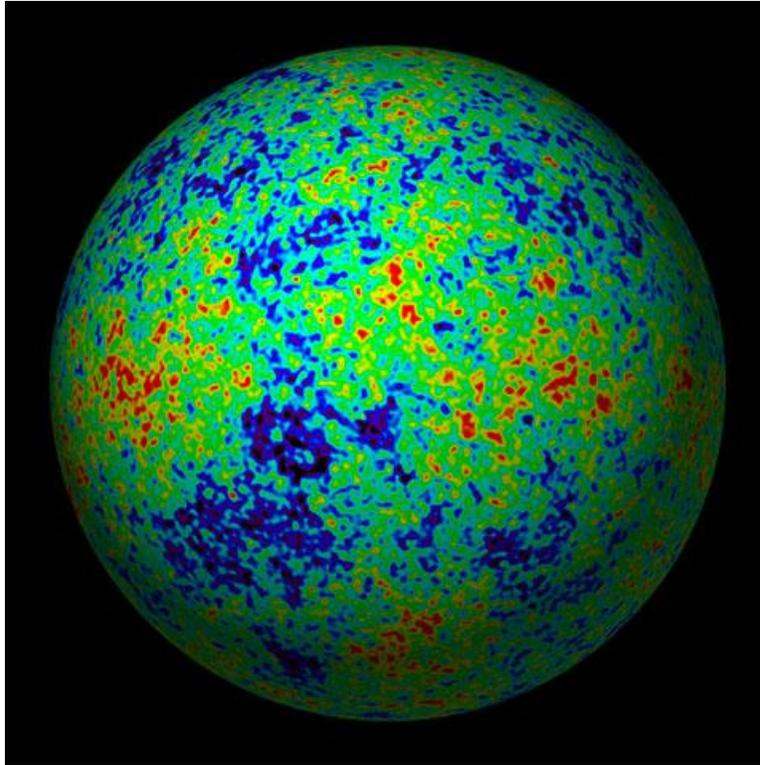


ASTR422 Cosmology (Fall 2016; Reynolds)



Prof: Chris Reynolds

Phone: (301)405-2682

E-mail: chris@astro.umd.edu

Office: PSC1154

Class Schedule : 12.30-1.45pm Tuesdays and Thursdays; room CSS2428.

Office hours: 10.30—11.30am Tuesdays, or by appointment

Textbook: “An Introduction to Modern Cosmology” by A.Liddle (3rd 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 is 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.***

Aid and Assistance : If you are experiencing difficulties in keeping up with the academic demands of this course, please consider contacting the Learning Assistance Service, 2202 Shoemaker Building, [301-314-7693](tel:301-314-7693). Their academic coaches can help with time management, reading, math learning skills, note-taking and exam preparation skills. All their services are free to UM students.

Grading

Grades are based on a point scale with weights as shown below.

Homeworks (6)	30%
Project paper	15%
Midterm exam	25%
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 13th October 2016. This exam will be closed book, and calculators will be allowed. The exam will consist of a section of short-answer problems followed by a section of longer/multi-part 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 (see below). In essence, you must inform me in a timely manner and provide documentation if you need to miss this exam (a self-signed note is not sufficient).

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 Monday 19th December 2016 at 1.30-3.30pm in room CSS2428. 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 below). In essence, you must inform me in a timely manner and provide documentation if you need to miss this exam (a self-signed note is not sufficient).

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%. Solution sets will be handed out one week after the due date, and late homework absolutely cannot be accepted after this time. 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 PSC1154) **before** the time that it is

due. In situations where you are unable to make the homework deadline for any reason, the excused absences policy (see below) applies.

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.

Class Project

A significant component (15%) of the grade for this class will be based on a project paper. Detailed information about this project will be announced later in the semester.

Excused Absences and Student Grievance Policies

The University has recently changed the excused absence and student grievance policies. The new policies can be found at

<http://www.president.umd.edu/administration/policies/section-v-student-affairs/v-100g>

<http://www.president.umd.edu/administration/policies/section-v-student-affairs/v-100a-0>

These are substantial and nuanced documents - please familiarize yourself with them.

University Course Related Policies

The Office of Undergraduate Studies has developed a student-oriented webpage which brings together information about relevant undergraduate student/course policies and procedures:

<http://www.ugst.umd.edu/courserelatedpolicies.html>

This is important information with which you should familiarize yourself.

Preliminary course outline

DATE	TOPIC	CHAPTER
	Cosmological basics	
8/30/2016	Introduction; The Cosmological Principle	1,2
9/1/2016	Hubble's Law Renewed; the Friedman Equation	3
9/6/2016	Cosmological Fluids	3
9/8/2016	Flat Space Cosmological Models	5
9/13/2016	GR and introduction to metrics	AT1
9/15/2016	The FRW metric	AT2
9/20/2016	The Geometry-Density-Dynamics Connection	4
	Taking a measure of our Universe	
9/22/2016	Weighing the Universe	9
9/27/2016	The age of the Universe	8
9/29/2016	Photon propagation in FRW metric & distances	AT2
10/4/2016	Discovery of the acceleration of the Universe	AT6
10/6/2016	Concordance Cosmology	AT6
10/11/2016	Pre-midterm review	
10/13/2016	<i>MIDTERM**</i>	
	The Hot Big Bang	
10/18/2016	Discovery of the CMB and its implications	10
10/20/2016	Hot big bang & thermal history of the Universe	11
10/25/2016	The hadron and lepton eras	-
10/27/2016	Primordial nucleosynthesis	12
11/1/2016	Formation of the CMB	10
	The formation of structure	
11/3/2016	Gravitational instability and structure formation	AT5
11/8/2016	Linear & non-linear phases of structure formation	-
11/10/2016	Galaxy formation & the need for feedback	-
11/15/2016	AGN feedback	-
	Inflationary cosmology	
11/17/2016	The four problems of standard cosmology	13
11/22/2016	Inflationary models	13
11/24/2016	THANKSGIVING	
11/29/2016	Special Topic	
12/1/2016	Special Topic	
12/6/2016	Project presentations/work	
12/8/2016	Review session	

12/19/2016 FINAL EXAM (1.30-3.30pm)**

** = MAJOR SCHEDULED GRADING EVENT