

# Astro 2010 - Modern Cosmology (Fall, 2018)

**Class:** Mon/Wed/Fri 1:00-1:50 pm, Duane G131

**Overview:** Cosmology is the oldest science and addresses the biggest questions that exist. Humans have wondered “*where did we come from?*” since the dawn of time. In this class, we will discuss the origin and structure of the universe and what its eventual fate will be as determined through modern scientific methods. Cosmology is a scientific as well as philosophical subject and I encourage you to think big. We will focus not only on what we know, but how we know it and what we don’t know. By the end of class you will have a basic understanding of the modern cosmological model and how scientists have arrived at this detailed (and often bizarre) theory. To get there, we will cover just enough of the underlying physics and astronomy to make the theories understandable. Major topics we will cover include: the scientific method, observational tools of astronomy, stars and galaxies, the nature of space and time, the Big Bang, the expansion of the Universe, the origin of atomic elements, dark matter and dark energy, and the growth of what we see today.

Instructor:

**Dr. Charles Danforth**

[danforth@colorado.edu](mailto:danforth@colorado.edu)

office: Duane D321

hours: TBD

and by appointment

**Who should take this class:** ASTR2010 is designed as a stand-alone, single-semester course on cosmology with no assumed prior astronomical knowledge. If you have already taken one of the 1000-level Stars & Galaxies classes (ASTR1020 or ASTR1200), particularly if you took it with me, this course will repeat a lot of the same information (and jokes) you saw in that class. However, ASTR2010 will explore the cosmological topics covered briefly in the other classes with much more rigor.

**Prerequisites:** This class has no formal prerequisites, only a natural curiosity and an open-mindedness to some non-intuitive concepts. This course covers the concepts of cosmology non-mathematically as much as possible. However, **there will be some math** (see the FAQ below). You will be expected to use some simple proportional and algebraic relations and to manipulate and interpret numbers and physical units. For a review of some math skills, see <http://lasp.colorado.edu/~bagenal/MATH/main.html>.

## Required Materials:

★ **Textbook:** “*Your Cosmic Context*” Duncan & Tyler will be our main text. Readings will complement lectures.

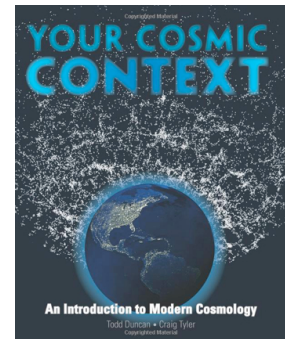
★ **iClicker:** You will need an iClicker to participate in in-class exercises.

★ **Supplemental texts:** I will supplement the textbook throughout the semester with readings from other sources. These will be made available on D2L.

**Class Format:** The class will consist of lectures, in-class discussions, and exercises. I encourage you to interact with me and your classmates and it is important that you both read the textbook and attend classes regularly.

**Desire2Learn (D2L):** The course web page is the place to find assignments, an up-to-date class schedule. I will post lecture notes after class and homework solutions after assignments are due. I will also post supplemental reading material there.

**Observatory:** We have XXX evenings reserved at the Sommers-Bauch Observatory (on campus, adjacent to the Fiske Planetarium). We will use these sessions (weather permitting) as an informal opportunity to see objects of astronomical beauty (and often cosmological importance!) with our own eyes through the observatory’s two large telescopes. In addition, there is a **weekly open house** every clear Friday starting at 8 pm. You are encouraged to attend at least one observing session during the semester, but it is not required.

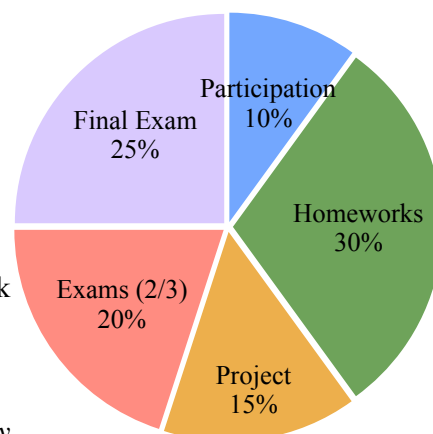


**Your Grade:** Your final grade is determined from the following components:

**(30%) Homework Assignments:** There will be written homework assignments (problem sets and other assignments) due every 2-3 weeks throughout the semester. You are encouraged to work together to solve problems, but the work must be your own. *Any homework solutions which appear to be copies of each other will result in a grade of 0 for both homeworks and a report to the Honors Council*, thus it is in your best interest not to let anyone copy directly from you. HW will be available either in print or for downloaded from class website and is due in class. Late homework will receive half credit up until the point when solutions are posted after which no credit will be given. In addition, students are required to complete either of the following:

- Attend an observing session at the *Sommers Bausch Observatory* (SBO) on campus. Observe three (or more) different types of objects, sketch and/or photograph them, and write a brief report. Details are given on the SBO Observations assignment document on D2L. SBO dates are still pending but will be announced in class. Since telescopes can't see through clouds, all SBO nights are weather-dependent.
- Attend a public faculty lecture at the Fiske Planetarium (or similar) and write a 1-2 page essay on the subjects covered. Essay will be turned in electronically and graded as a writing assignment. Public talks will be announced in class as I hear about them. If you hear of another public talk you think would fit this assignment, please let me know and I will announce that as well.

The lowest Assignment (written homework or SBO/Fiske event) will be dropped.



**(15%) Project:** Early in the semester, I will hand out a list of independent research project ideas. These will include watching a cosmology-related movie/documentary, anthropological essays, archeo-astronomy topics, and several others. You are free to devise a project of your own as well. Most will involve a 3-5 page written component. You are to ***pick one*** of these projects to complete during the course of the semester and turn them in by December 5th (or earlier!).

**(10%) Class Participation:** Participation in class is important and will be partially assessed through iClicker questions. Full credit will be given for correct answers and half credit for incorrect answers.

**(20%) Exams (3) and (25%) Final Exam (1):** There will be three 50-minute, in-class exams during the course of the semester, each worth 10% of your grade (see schedule below). You may drop one of the three exams, therefore ***no make-up exams will be offered***. The final exam (2.5 hours) is mandatory and will be worth 25% of your grade. Final exam date/time will be announced early in the semester

## FREQUENTLY ANSWERED QUESTIONS:

***Is this going to be an easy-A?*** No.

***Can I get a make-up exam?*** No. See above.

***Do I need to tell you if I'm missing class?***

No. I do not take attendance in my class and I understand that attending lecture can't always be your first priority. If you're sick or stuck in traffic and are going to miss a class or two, I do not need to know about it. Take care of yourself, get well, and come back when you are ready. I don't need doctors notes. However, if you are hospitalized or will miss more than a week of class, please let me know and we will work something out.

***How can I get help?*** The most important part of getting help is to ask for it. There are many resources from office hours, TA help sessions, the Astronomy Help Room, and many others. Office hours (listed at the top of page 1) should be your first choice, but if those don't work in your schedule, the TA and professor are both available by email for specific questions or to set up in-person meetings. Our job is to help you learn. Just ask for help when you need it.

***Where the \$#&@! is your office?*** The Duane building is very confusing. To find my office (D321), walk west (toward the mountains) down the hall from our classroom through two sets of double doors. Immediately on your right you'll see an elevator and a door to a stairway. Go up two floors. My office is the first door on the right and is labeled as such.

***Will there be math?*** Yes, however nothing beyond the level of math you learned in high school (algebra and basic geometry) and needed to be accepted at CU in the first place. However, we will often approach math in a less rigorous, more abstract way than you may be used to. We will use ratios extensively and make approximations and "back of the envelope" calculations a lot. You will rarely need a calculator in this class and never on an exam. Astronomy requires proficiency with very large and very small numbers, so there will be an emphasis on scientific notation, powers of ten, and scaling. If you need help with the math, just ask.

***Is there a curve?*** Yes. Do not expect the usual percentage-letter grade conversions you may be used to from high school to apply here. My exams are challenging and your numerical grades may be surprisingly low. Median exam scores are typically about 65%... and that usually corresponds to a low-B grade. If you get 80% or better on something, that's good. 50% or worse... not so good, but not as bad as you may think.

***So how does the curve work?*** Your overall course grade (at the end of the semester) is the only thing which is curved. Individual items are not curved and the grade you see on D2L for any item represents a raw (uncurved) score. Individual course components will not be curved, but I will publish approximate letter-grade equivalents after each exam and give you at least one curved mid-semester assessment based on the work graded to date.

***What is dropped?*** The lowest of your 3 midterm grades is dropped. Your lowest "assignment" score is dropped (written homeworks, observing, public lecture). Everyone gets 5 days of clicker forgiveness which should cover absences and technical problems; additional absences will be counted against you.

## ***How can I succeed in this class?***

*I will do everything I can to help you learn, but your education is ultimately up to you and you alone.*

- Participate in class - sit near the front and ask questions. Attend regularly.
- Put away your phone and laptop.
- Don't settle for being confused. There are no "dumb" questions; if you are confused, I guarantee that there are at least ten others in class who are just as confused but are not brave enough to speak up.
- Buy and read your textbook.
- Turn in every assignment; partial credit is a lot better than no credit.

People who do poorly in class are the ones who miss class, miss homeworks, or are "multi-tasking" in the back of the room.

***You will receive the grade you work for.***

### CLASS POLICIES:

My overlying principle is that **I will treat you as an adult**. Specifically, this means the following:

- ★ You are expected to be proactive about your education. Make the effort to know what is required for the class and do it in a mature manner.
- ★ Do not leave class early and don't start packing up before class is dismissed. Both are rude to me and disruptive to your fellow students. I will never lecture beyond our allotted class time and will occasionally end class a few minutes early. If you *need* to leave early, please let me know at the beginning of class, sit near the rear of the room, and leave as quietly as possible.
- ★ **Laptops and tablets** may be used in class (though it is discouraged), and **only** for taking class notes. Everyone using a laptop must sit on the **west (left) side** of the classroom in the **front three rows**. Even if you yourself are not using a screen, having one in your field of vision is extremely distracting. Know this and plan accordingly.
- ★ **Phones** must not be used during class for any reason. Even "just texting" is very rude and will not be tolerated. Participation points will be docked from violators without notice.
- ★ Know what is and isn't allowed in completing problem sets and exams.

### OTHER POLICIES:

*(please see electronic version of this syllabus on D2L for active hyperlinks to relevant information)*

**Inconsistencies:** There may be occasional inconsistencies between this syllabus and other class materials. Unless I specifically say otherwise, the policies laid out in this syllabus take precedence over all others. If you notice an inconsistency, please bring it to my attention.

### ***What constitutes plagiarism / cheating?***

*While I encourage students to work together to solve homework problems, each student's answers must be his/her own. Use the mantra "**work together, write separately**" to guide your actions. Every semester, I receive a number of homeworks with nearly-identical answers. **If I do not see any signs of independent thought in a response, both students will receive zero credit for the entire assignment and may be reported to the honors council. Don't be that person!***

*In written work (essays), it is expected that you utilize outside sources in your research, but that you cite them appropriately. Quoting references is acceptable with proper attribution, however cut/pasting text from another source as your own is plagiarism and constitutes very serious academic misconduct.*

**Honor Code:** All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code ([honor@colorado.edu](mailto:honor@colorado.edu)); 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

**Classroom Behavior:** Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on [classroom behavior](#) and the [Student Code of Conduct](#).

**Accommodation for Disabilities:** If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu) for further assistance. If you have a temporary medical condition or injury, see [Temporary Medical Conditions](#) under the Students tab on the Disability Services website.

### **Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation**

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or [cureport@colorado.edu](mailto:cureport@colorado.edu). Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#).

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

### **Religious Holidays**

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, I make allowances for students to drop one midterm exam and other items as well (see above). If this is insufficient to meet your religious obligations, please see me and we can discuss additional accommodations.

See the [campus policy regarding religious observances](#) for full details.