

Basic information

Title	Origin of the Universe	Instructor	Benedikt Diemer (he/him)
Number	ASTR 340 (Fall 2021)	Email	diemer@umd.edu
Website	ELMS/Canvas	Office	PSC 1107
Location	ATL 2400		
Lecture times	Tue/Thu 12:30 – 1:45pm	TA/Grader	Ernesto Benitez (he/him)
Office hours	Wed 3-4pm	TA's email	ebenite1@terpmail.umd.edu
	Thu 11am -12pm	TA's office hours	Mon 11am-12pm (on zoom)

Description

Welcome to *Origin of the Universe*! The goal of this course is to give you an overview of cosmology, the study of the cosmos. We'll start right at home in our own solar system but quickly branch out to our galaxy and to the Universe as a whole - how it started, how it's evolving, and how it'll end. Along the way, we'll encounter all kinds of bizarre physical and astronomical phenomena such as relativity, the Big Bang, dark matter, dark energy, and gravitational waves.

By the end of the course, you will...

- be able to paint an accurate picture of how the Universe formed and evolved
- use observations and the scientific method to support this picture
- have reached the boundaries of our current knowledge, such as multiverse theories and the nature of dark energy
- ...and, most importantly: crush it in debates with anyone bragging about their half-baked knowledge of gravity waves, wormholes, aliens, and other sci-fi topics!

Pre-requisites

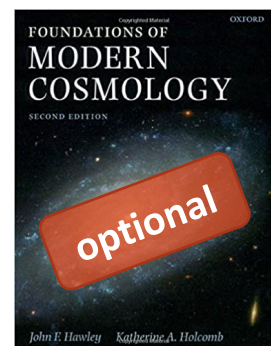
This course is intended for non-astronomy majors and assumes high-school-level algebra and general problem-solving skills. Either ASTR 100 or 101 are a prerequisite. We will try to keep the math as simple as possible, but cosmology is a fundamentally mathematical discipline, so some equations are inevitable.

Resources

Turning Point App: You will need a phone with the TurningPoint quiz app, which you can download for free in the AppStore or GooglePlay. Please create a TurningPoint account using your UMD email (the same as used in Canvas)!

Textbook (optional): John Hawley & Katherine Holcomb
Foundations of Modern Cosmology (2nd ed.)
Oxford University Press, ISBN 0-19-853096-X

Device for zoom: If lectures switch to an online format, you will need a device to access the zoom lectures and slides



Possible changes due to COVID

Although our goal is to return to a fully in-person campus environment this fall, we live in quickly changing times! It is possible that some aspects of the following policies might need to adapt on short notice, including the weekly and semester schedules, the exams, and the grading scheme (e.g., number of homework assignments or type of participation exercises).

Grading

The most important thing in this course is to stay connected and participate. To reflect this reality, participation, weekly quizzes, and homework make up **70% of your grade** (see table). You cannot pass this course by just focusing on exams! The second table gives the conversion from percentages to letter grades. **I may curve the final grade upwards.** I will use +/- grades (the ranges in the table include A+, A, A-, B+, B, B- and so on).

Participation

The participation grade will be composed of many small, in-class quizzes, discussions, and other contributions. In general, full credit will be given for responding. There is no need to let me know if you are missing a lecture, but please know that you will miss out on the participation credits. I understand that not everyone will be able to make it to every single lecture. Thus, the five lowest participation grades will be dropped.

Quizzes

A short multiple-choice comprehension quiz will be assigned after each lecture and will be due the following day at midnight (on ELMS/Canvas).

Homework






Homework will be assigned 6 times during the semester and will be due the following week. You will submit your homework digitally on ELMS/Canvas to accommodate our grader who will work remotely. Homework accounts for 30% of your overall grade, so please do not forget to turn it in. Late homework will only be accepted for excused, documented absences (see course policies below; the absence policy may change mid-semester due to COVID). There will not be any extra credit projects. Plagiarism on homework assignments is not acceptable - please see the Academic Integrity section below for a definition of plagiarism. Your homework answers may be checked using TurnItIn.

Exams

Assuming that class remains in person, the midterm and final will be in-class, closed-book exams. If we need to transition to an online mode, they will instead be synchronous open-book exams, where you would be allowed to consult your notes and lecture slides, but not to collaborate. The table below lists levels of collaboration that are acceptable for each type of graded exercise. If you are ever unsure about acceptable levels of collaboration, please ask!

Type of grade	Weight
Participation	20%
Quizzes	20%
Homework	30%
Midterm exam	10%
Final exam	20%
Total	100%

A	100 – 90%
B	<90 – 80%
C	<80 – 70%
D	<70 – 55%
F	<55%

	 Notes	 Book (opt.)	 Internet	 Collaborate	 Group
Participation (group work, quizzes)	✓	✓	✗	✓	✓
Comprehension quizzes	✓	✓	✓	✗	✗
Homework Assignments	✓	✓	✓	✗	✗
Midterm and final exams	✗	✗	✗	✗	✗

Course policies

It is possible that this course will end up in a hybrid in-person and online format, and our course policies reflect this unique situation. In general, our course policies follow the standard set by the University of Maryland, which you can find at ugst.umd.edu/courserelatedpolicies.html. Some of the most important policies are summarized below, and the following box highlights policies relevant in the case of online lectures.

Special policies for potential online lectures

- By default, our lectures will be in person and **not recorded**.
- Any online lectures will be held **on zoom**. One of the hardest things about that is not being able to see each other's faces. I appreciate it if you turn your video on, particularly for group activities -- but I also respect your privacy, meaning that you are not required to do so and that your grades won't depend on it.
- Any online lectures will be **recorded**. If you speak during the lectures, your face may be part of the recording. However, don't worry too much because...
- Any recorded lectures will be made **available on ELMS/Canvas**. You will need your login to access them, so nobody outside the course will be able to view them.
- You are **not allowed to share the lectures** on other websites or with anyone not in the course to protect your fellow students' privacy.
- **Academic integrity** is more important than ever, and I trust your honesty. Since we cannot have in-person exams, they will be open-book.

Masks in classroom

While UMD's masking requirements are in flux and likely to change during the semester, please expect to be wearing masks at all times in the classroom. Currently, face coverings over the nose and mouth are required while you are indoors at all times. In accordance with university policy, students not wearing a mask will be given a warning and asked to wear one, or will be asked to leave the room immediately. Students who have additional issues with the mask expectation after a first warning will be referred to the Office of Student Conduct for failure to comply with a directive of University officials.

Accommodations

If you have a documented disability and wish to discuss academic accommodations, please contact me as soon as possible. In accordance with University policy, I ask that you inform me of exam accommodations at least three days in advance.

Religious observances

It is the student's responsibility to inform the instructor in advance of any intended absences for religious observances. This prior notification is especially important for final examinations because failure to reschedule a final examination before the conclusion of the exam period may result in zero credit.

Academic Integrity

UMD has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. University standards regarding academic integrity apply to all work performed for credit in this course, and as a student you are responsible for upholding these standards. Particulars of the University's Code are printed in the Undergraduate Catalog, and a description of what constitutes academic dishonesty is also given in the on-line Schedule of Classes. In brief, the Code requires that you must never engage in acts of academic dishonesty at any time. Acts of academic dishonesty include **cheating, fabrication, plagiarism, or helping another person to do any of these things**. Violation of the Code carries very serious consequences; for more information, please visit shc.umd.edu. The rules regarding academic integrity **apply to homework** as well as to exams. As a part of these rules, you must give credit to any book, published article, or web page that you have used to help you with a particular assignment (including unpublished sources of information). Students are encouraged to discuss assignments and other class material with each other, but every student must personally think through and write up their own answers to the homework questions.

Course Evaluations

As a student member of our academic community, it is your responsibility to participate in the evaluation of courses. Your feedback is confidential and important to the improvement of teaching and learning at UMD as well as to the tenure and promotion process. You can enter your evaluations on CourseEvalUM some time in November. The process should take less than 20 minutes, and the sooner it's done the less it'll get in the way of studying for the finals. By completing your evaluations each semester, you will have the privilege of accessing the evaluation reports for the thousands of courses for which 70% or more students submitted their evaluations (online at Testudo).

Communication with the instructor***ELMS/Canvas***

I will send important announcements via ELMS/Canvas messaging. Please make sure that your **email and announcement notifications** (including changes in assignments and/or due dates) are **enabled** in ELMS/Canvas so that you do not miss any messages. You are responsible for checking your email and ELMS/Canvas inbox with regular frequency.

Email

If you need to reach out and communicate with me, please email me at diemer@umd.edu, using "ASTR 340" in the subject line. Please consider that there are 60 students in this course, meaning that responding to all emails will be a significant effort. I ask that you do not email me with questions that are answered in this syllabus or on the ELMS/Canvas page (e.g., When is this assignment due? How much is it worth? etc.). However, please DO reach out about personal, academic, and intellectual concerns or questions. I will do my best to respond to emails within 24 hours on lecture days and within 48 hours during the rest of the work week.

Communication with your peers

This course encourages scientific discussion and collaboration as a means of learning. Thus, we will find likely find ourselves in disagreement or debate at times. It is important that we agree to conduct our conversations in a professional manner and to foster a virtual classroom environment in which everyone feels included and respected. I will make every reasonable attempt to create an atmosphere in which every student feels comfortable voicing their argument without fear of being personally attacked, mocked, demeaned, or devalued. Any behavior that threatens this atmosphere will not be tolerated, including harassment, sexual harassment, and derogatory language with respect to race, gender, culture, nationality, or any other personal characteristic. In discussion, please let everyone speak and respect each other's point of view. Please alert me immediately if you feel threatened, dismissed, or silenced at any point during our semester or if your engagement in our discussions has been hindered by the learning environment in any way.

Tips for success

Many of the following are good practices in general, but they are particularly important if there is an online component to our course:

- **Participate** • Discussions and group work are a critical part of the course. You can learn a great deal from discussing ideas and perspectives with your peers and professor.
- **Manage your time** • Give yourself plenty of time to complete assignments including extra time to handle any technology-related problems.
- **Log in regularly** • We will use ELMS/Canvas for announcements and discussions. You may need to log in multiple times a day, e.g., when submissions are due.
- **Use ELMS/Canvas notifications** • Canvas can ensure you receive timely notifications in your email or via text. Be sure to enable announcements to be sent instantly or daily.
- **Do not fall behind** • This class moves at a quick pace and each week builds on the previous. It will be hard to keep up if you fall behind in the pre-work or post-work.
- **Ask for help** • Everyone has been struggling during the COVID pandemic, so please reach out if life gets in the way of your progress! If a course concept is unclear, also get in touch with your classmates – chances are you'll find that you're not alone. If you need help with ELMS/Canvas or other technology, please contact IT Support.

Weekly schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
11:00-12:00	TA office hours			Office hours	
12:00-12:30					
12:30-1:45		Lecture		Lecture	
1:45-3:00					
3:00-4:00			Office hours		
4:00-11:59					
11:59			Tue quiz due		Thu quiz due

Semester schedule

Please note that the textbook readings are optional and will not be required for full credit, but they can provide an additional resource. The chapters roughly cover the content of the respective lectures.

Date	#	Topic	Book	
Part I: History of cosmology				
Tue	8/31/2021	1	Our place in the Universe: creation myths	Ch. 1
Thu	9/2/2021	2	Ancient steps towards a scientific cosmology	Ch. 2
Tue	9/7/2021	3	Self-centered cosmology: geocentric and heliocentric pictures	
Thu	9/9/2021	4	Physical laws for the Universe	Ch. 3
Part II: Space, time, and relativity				
Tue	9/14/2021	5	Principles of space and time I	Ch. 6
Thu	9/16/2021	6	Principles of space and time II	
Tue	9/21/2021	7	Special Relativity I	Ch. 7
Thu	9/23/2021	8	Special Relativity II	
Tue	9/28/2021	9	General Relativity I	Ch. 8
Thu	9/30/2021	10	General Relativity II	
Part III: Modern cosmology				
Tue	10/5/2021	11	The Universe beyond our Galaxy	Ch. 10
Thu	10/7/2021	12	The expanding Universe	Ch. 11
Tue	10/12/2021	13	Density is destiny	
Thu	10/14/2021	14	Dark energy and the accelerated expansion	
Tue	10/19/2021	---	Review/practice session	---
Thu	10/21/2021	---	Midterm exam	---
Tue	10/26/2021	15	The very, very early Universe	Ch. 12
Thu	10/28/2021	16	Are we all made of star stuff?	
Tue	11/2/2021	17	The cosmic microwave background	Ch. 14
Part IV: The limits of our knowledge: Contemporary cosmology				
Thu	11/4/2021	18	Measuring the invisible	Ch. 13
Tue	11/9/2021	19	Concordance cosmology and the Hubble tension	
Thu	11/11/2021	20	The cosmic web of dark matter	Ch. 15
Tue	11/16/2021	21	From dark matter halos to galaxies to stars	---
Thu	11/18/2021	22	The Milky Way in context: Galaxy evolution	---
Tue	11/23/2021	23	Black holes	Ch. 9
Tue	11/30/2021	24	Listening to the Universe with gravitational waves	---
Thu	12/2/2021	25	Inflation and multiverses	Ch. 16
Tue	12/7/2021	26	Our place in the Universe and the anthropic principle	---
Thu	12/9/2021	---	Review/practice session	---
Mo	12/20/2021	---	Final exam (1:30-3:30 pm)	---