

Introduction to Astronomy (AST 301)

Fall 2023, Unique Number: 48240

MWF 1:00–1:50pm, WEL 3.502

<i>Lecturer:</i> Dr. Will Best (he/him)	Office hours: Wed 11am Office: PMA 15.322	Phone: (512) 232–3495 Email: wbest@utexas.edu
<i>Teaching Assistant:</i> Aayush Goel (he/him)	Office hours: Mon 10:45am, Thu 11am on Zoom Help center: PMA 16.304B	Email: aayushg@utexas.edu
<i>Teaching Assistant:</i> Ajit Gopalakrishnan (he/him)	Office hours: Mon 2:30pm, Fri 2:30pm Help center: PMA 16.304B	Email: ajitg@utexas.edu
<i>Undergraduate Assistant:</i> Trevor Erwin (they/them)	Office hours: Wed 2pm Help center: PMA 16.304B	Email: trevor.erwin2020@gmail.com

Course Description

This course will introduce you to a broad range of topics in astronomy, as well as the scientific thinking that has led us to what we know about the universe.

The course is divided into three parts:

1. History of Astronomy and the foundations to understand the universe
2. The solar system, other planets, the Sun, and other stars
3. Galaxies, the building blocks of the large-scale universe, and the Big Bang

Course-Level Learning Goals: We will explore what we know about the origin of the solar system, stars, galaxies, and the universe as a whole through the lens of exploration and scientific discovery. We will uncover the physical understanding that humanity has collectively developed to comprehend what we see in the universe, and we will pay close attention to the actual discovery process.

We will primarily strive to learn concepts using description, visualization, and critical thinking. We will use some math, up to high-school level algebra.

Prerequisites: None!

Course Details

In-person classes: We will meet on Mondays, Wednesdays, and Fridays from 1–1:50PM in Welch Hall 3.502. Attendance is expected but will not be enforced. There will be no live online way to attend class, but lectures will be recorded. If you are not feeling well, please do not attend class and reach out to the Teaching Assistants or me if you need the recording. Lecture slides will be posted on the class Canvas page. If you get sick or are otherwise unable attend class, please email the TAs and me immediately and we will ensure that you receive the proper accommodations (i.e., extensions on homework/exams).

COVID-19: The University does have a policy for [what you should do if you get COVID](#). Please isolate for 5 days after your symptoms start and wear a mask for at least 10 days. Email your TAs so we can support you.

Canvas Course: This course will be primarily run through the Canvas system, at canvas.utexas.edu. All class communication and grades will be available on Canvas, and lectures slides will be posted following each class. This is also where you should ask questions of your fellow classmates. There is a portal to the MasteringAstronomy course through Canvas (see below), which is your gateway to using your textbook. You will access your homework assignments and exams in MasteringAstronomy through Canvas. You are responsible for checking Canvas daily and familiarizing yourself with how to use it. I recommend setting up email alerts to be notified when we send messages or post assignments. You may also wish to download the mobile app.

Bring to Class:

A laptop or device that can connect to UT Instapoll (e.g., phone with Canvas app)

A laptop, device, or paper and pen for taking notes

Use of Electronics: Students using their electronics for non-class activities are a distraction to those around them. If we find your use of electronics to be a distraction to others, we will ask you to leave the classroom. Also, if you are distracted by non-academic use of electronics by a fellow student, you can ask them directly to stop or notify the instructor or a TA.

Class Structure: We will combine short lectures with group activities and informal quizzes using Instapoll. Most days will include some problem sets that you will answer in MasteringAstronomy for extra credit in collaboration with your classmates. There will be a substantial amount of class time where you are talking about the mysteries of the Universe with your classmates, the Teaching Assistants, and me! Advice: Take advantage of these times. Talk through the problems and help each other understand the problems. Make sure that *everyone* in your group understands the answer. You will find that you do not truly understand the Universe until you have to teach someone else about it. Helping someone understand something will do just as much to help you as it will them.

Required Reading: A crucial aspect of this class structure is that you must be ready to discuss with your classmates. Coming prepared for class is essential. Doing the pre-class reading is the best way to prepare. The required reading is listed in the schedule below, and will be linked on Canvas and posted on the MasteringAstronomy calendar. The required reading is typically between 5-20 pages and usually contains helpful diagrams.

Communication: Your first point of contact for communication is your TAs, Aayush Goel and Ajit Gopalikrishnan. Your next point of contact is Dr. Best. Please use Canvas or email to send a message to your TAs and/or Dr. Best with questions, concerns, etc. We will aim to respond during normal working hours (M-F, 9am-5pm) within 24 hours.

Canvas Message Board: If you have a course-related question (not a personal question), please post first in the Canvas message board. One of your classmates or a TA might see it and respond with the solution. Have a conversation with them! Figure out the problem together. If after 6 hours no one has responded to your canvas message, please send me an email and I will happily help you. There are over 200 students in the class and it becomes prohibitively challenging to answer all questions, but I am here for any questions that others cannot answer.

Office Hours: See the top of this syllabus. You can schedule another time to meet with us, in person or over Zoom, by emailing to make an appointment.

Course Textbook and Digital Materials

This course requires three different digital materials (2 are bundled together):

1. [The Cosmic Perspective](#), Edition 9, by Bennett, Donahue, Schneider, and Voit
2. MasteringAstronomy (bundled with Cosmic Perspective)
3. Stellarium

Textbook: *The Cosmic Perspective* is a widely-used text with lots of chapters, pretty figures, and good practice problems.

Each lecture is paired with 5-20 pages of reading from *The Cosmic Perspective* and (1) listed at the end of this syllabus, (2) linked on the Canvas Course page, and (3) posted in the MasteringAstronomy calendar. You will greatly benefit if you do this reading before lecture.

This semester we are using the Longhorn Textbook Access (LTA) version of this textbook. This service provides you with the eText of *Cosmic Perspective* and MasteringAstronomy for half the sticker price for the combination. This does mean that you will not have a physical copy of the book. I HIGHLY RECOMMEND THAT YOU PARTICIPATE IN LTA. It is not required, but you won't find a better deal for the book plus the Mastering software, and it will dramatically simplify your life. <https://www.universitycoop.com/longhorn-textbook-access/>

Billing tl;dr: Everyone will be automatically billed for the e-book by August 28th. You can opt-out at any time until September 6th through Canvas (although I recommend that you don't). You must pay the bill by September 18th to continue access to the book.

Billing details: You are automatically opted into the LTA program but can easily opt-out (and back in) via Canvas through the 12th class day (September 6th). Again, I highly recommend that you opt in for LTA; past students who opted out have experienced several issues that were hard to navigate. If you remain opted-in at the end of the 5th class day (August 25th) you will receive a bill through your "What I Owe" page and have until the end of the 20th class day (September 18th) to pay and retain access. You can still opt out through the 12th class day (the bill will be removed). If you do not pay by the 20th class day, you will lose access to the materials and your charge will be removed. More information about the LTA program is available at <https://www.universitycoop.com/longhorn-textbook-access/>.

MasteringAstronomy: MasteringAstronomy pairs *The Cosmic Perspective* with Canvas. It allows the class to be run completely online. MasteringAstronomy will contain your reading assignments, homework and group work, and exams. You can also access the eText version of *The Cosmic Perspective* through MasteringAstronomy. It is a crucial component to the class.

[Make sure that you sign up for MasteringAstronomy immediately.](#)

You can set up your MasteringAstronomy by going to the "My Textbooks" section of our Canvas Course.

Click on "My Textbooks" — this will bring you to a UT Coop page.

Click on "Launch Courseware" — this will bring you to a Pearson website.

Click on "Open MyLab and Mastering" — this will open a page where you register for the course.

You will need to create an account if you are new to MyLab and Mastering. Once you create an account you will be able to select an available access option and access our Course Content.

You will need to purchase access to MasteringAstronomy at the time that you sign up for the course. The LTA version of the textbook comes with Mastering included, and you should have access to it right away. If you choose to opt-out of the LTA program, there should be a free two-week trial period for MasteringAstronomy that will enable you to access the course content immediately if you are waiting for financial aid.

Stellarium: Stellarium is a *free* virtual planetarium software that we will pair with MasteringAstronomy to do group labs. You can download the free version of the software from <https://stellarium.org/>. I recommend downloading the software onto your computer because the web-based version does not have all of the functionality that we will use. We will have a walkthrough of some of the functionality of Stellarium on the first day that we use it, but I encourage you to explore the many good YouTube videos available that show some of Stellarium's functionality.

That's a lot of technology: It's true. It's crucial for this class that everyone is able to access and understand the electronic platform. However, the class grade is not supposed to be about exploring computer issues. Leave plenty of time to take exams, in case MasteringAstronomy decides to crash at an inconvenient time. If you are having issues answering the in-class extra credit question, let a TA or me know.

We will accommodate *reasonable* technological issues. I especially understand and recognize that computers are not uniformly available for all UT students. Since you have the option of doing the homework and group work on your own, explore the option of computer labs on campus. The University also has funds available for students in financial need to help address technological needs. Please check <https://cns.utexas.edu/students/support/student-emergency-funding> for more information. If you have further issues accessing computers, please come to us and we will do whatever we can to get you online. If you have trouble accessing your MasteringAstronomy or Canvas passwords or usernames, please contact either Mastering or Canvas directly. If you have issues using the webpages or accessing the electronic content of the class, you have a couple options: (1) post on the Canvas message board, or (2) email the TAs or me. We will do our best to help you.

Grading Components and Policies

You will receive the grade you earn. The composition of the course grade is:

- Homework = 70% (~2% per assignment)
- Exams = 30% (three take-home, open book exams, 10% per exam)
- Up to 4% extra credit for in-class participation (0.1% per class)

This class will not be graded on a curve. The final course grade will be assigned as follows (where the numbers represent the percentage of total points). Everything will be rounded to the nearest hundredth percent (0.01%). This means that a 90.993% will receive a B+ and a 90.996% will receive an A-.

94.00 — 100% = A	79.00 — 82.99% = B-	67.00 — 69.99% = D+
91.00 — 93.99% = A-	76.00 — 78.99% = C+	63.00 — 66.99% = D
87.00 — 89.99% = B+	73.00 — 75.99% = C	60.00 — 62.99% = D-
83.00 — 86.99% = B	70.00 — 72.99% = C-	0 — 59.99% = F

When checking your grade, please look at both Mastering and Canvas. Sometimes Canvas can be out of sync. Canvas also has unfortunate defaults that display the grade assuming that you

have not missed any assignments. If you have missed assignments this could make you think that you have a higher grade than you actually do.

Homework (70%): There will be about 35 short assignments, each worth 10 points or 2% of your final grade, that will be posted on MasteringAstronomy. Assignments will be due at the **start** of every class **except exam days and the next class after exams**. The homework assignments are listed in this syllabus and will be clearly marked a week ahead of time in MasteringAstronomy. Homework submission closes at **12:59 PM** on the due date (the day the assignment is listed on the schedule below).

The late homework policy will subtract 20% from your final grade for every day that the assignment is late. After five days, submitting the assignment will not result in any credit.

The homework assignments, and how much you will have to do outside of class, will largely vary upon the day. The majority will be take-home problems covering material that we discussed in the preceding class. Some assignments will completely be problems that we do together in-class and submit through MasteringAstronomy. If you are not able to complete the assignments with your group during class, you will still have until the start of the next class to complete and submit the assignment.

For all MasteringAstronomy homework assignments you will have two chances to submit the correct answer. If you initially submit the wrong answer, MasteringAstronomy will give you a hint and allow you to change your answer. Try to learn from this and do not just guess.

Exams (30%): All exams will be open note and will be taken within MasteringAstronomy. Each exam will be worth 50 points, or 10% of your total grade. You will have 50 minutes to take each exam, self-scheduled. The exams will open immediately after the class in which we review the material and will stay open until the start of the class (12:59 PM) after the class designated for the exam. This means that you will have at least 4 days to take the exam. We will **NOT** have class on exam days. This gives you the option of when to take the exam: during our normal class time or any other 50 minutes during the 4 days that the exam is open. There is **no** cumulative final exam.

SSD students needing testing accommodations must contact a TA a week in advance, and we must have an SSD letter on record.

You are expected to do exams by yourself. This means that there should be no collaborative work on exams and each individual should take their own exam by themselves.

Exam questions will be similar in content and spirit to homework and group work questions. If you review and understand the homework problems, you will do great on the exams.

If an emergency or personal event occurs which causes you to miss one of the exams, and you contact me prior to the start of the exam, I will work with you to schedule a makeup. If you are on official university travel, I will arrange with you to take the exam before or after your trip.

Extra Credit — in-class participation: In most classes there will be one conceptual question that you will have to answer and place into Mastering. I will let you discuss this question with your classmates to make sure you answer the question correctly. The question will only be

open during the class, so you must input your answer before the end of class. You will receive 0.5 points (0.1%) extra credit for answering each question. This means that if you attend all the lectures you can receive enough points to miss two homework assignments and still receive a 100% final score. You will not receive makeup attendance credit regardless of a legitimate excuse for missing class.

Other Important Things

Accommodations for disabilities and/or family responsibilities: If you have any kind of disability, whether apparent or non-apparent, learning, emotional, physical, or cognitive, and you need some accommodations or alternatives to lectures, assignments, or exams, please contact Dr. Best to discuss reasonable accommodations for your access needs. Students with disabilities should also request appropriate accommodations from UT's Services for Students with Disabilities at <https://diversity.utexas.edu/disability/>.

I also recognize that students with children or family care responsibilities might require special accommodations on occasion, and they should contact me by email regarding missed or late work.

Expected behavior: Everyone is welcome here. Trying to understanding the universe is an age-old human pursuit that everyone should feel comfortable exploring. We aim to create an environment that is free from bullying, harassment, and micro-aggressions. Any such behavior will not be tolerated in this classroom or related workspaces. If there is ever an issue please do not hesitate to bring it to my or the TAs attention and we will pursue it to the fullest extent of University policies.

Title IX makes it clear that violence and harassment based on sex and gender are civil rights violations subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources through the University Title IX Office (512-471-0419), UT Austin Campus Police (512-471-4441), the Student Ombuds Services (which can provide *confidential* advice, resources and help; 512-471-3825), and the UT Counseling and Mental Health Center (512-471-3515).

Academic Dishonesty: Any indication of cheating will result in an automatic zero on the assignment. I reserve the right to pursue any act of academic dishonesty to the furthest extent of University policy, including but not limited to failure of the class and being reported to Student Judicial Services in the Dean of Students Office. In this case, Judicial Services will determine the final penalty.

Mental Health Resources: School can be stressful, and the past few years have been challenging for everyone. Your TAs and I are here to help you with any aspect of your exploration of the universe, so please come to us if you are having mental health issues and we will listen. However, we are not trained counselors. The university provides mental health support through the Counseling and Mental Health Center (<https://cmhc.utexas.edu/>) where you can access confidential counseling services free of charge. There is also a 24-hour crisis hotline (512-471-2255) where you will immediately be put into contact with someone. You have people in your corner that are always here to support you

Course Schedule

	Class Day	Topic	Homework due pre-class through MasteringAstronomy	Pre-class reading
1	M Aug 21	Introduction	--	--
2	W Aug 23	MasteringAstronomy Scale of the universe	--	Syllabus
3	F Aug 25	Timeline of the universe	Intro to MasteringAstronomy	Ch 1.1 & 1.2
4	M Aug 28	Motion of stars, causes of the seasons, and the moon	Ch 1.1 & 1.2 Powers of 10	Ch 2.1–2.3
5	W Aug 30	The history and development of astronomy	Ch 2.1–2.3 Units	Ch 2.4–3.3
6	F Sept 1	In-class lab and group work: Motion of the stars	Ch 2.4–3.3	Watch pre-class videos
7	W Sept 6	What is science? Describing motion and Newton's Laws	In-class group work on Stellarium	Ch 3.4, 4.1, 4.2
8	F Sept 8	Conservation laws, gravity, and orbits	Ch 3.4, 4.1, 4.2	Ch 4.3–4.5
9	M Sept 11	In-class lab and group work: Measuring the mass of Jupiter	Ch 4.3–4.5	
10	W Sept 13	Energy, conservation laws, and the basics of light	Stellarium	Ch 5.1 & 5.2
11	F Sept 15	Using light to determine the properties of matter	Ch 5.1 & 5.2	Ch 5.3
12	M Sept 18	Learning about the universe with light	Ch 5.3	Ch 5.4
13	W Sept 20	Exam 1 Review	Ch 5.3 & 5.4	Exam 1 goes live after class
14	F Sept 22	EXAM 1: Basics of the universe, Chapters 1–5	No class, remember to take the exam!	
15	M Sept 25	Our planetary system	Exam 1 closes at start of class	Ch 7.1–7.3
16	W Sept 27	Formation of the Solar System	Ch 7.1–7.3	Ch 8.1 & 8.2
17	F Sept 29	Planetary geology	Ch 8.1 & 8.2	Ch 9.1 & 9.2
18	M Oct 2	Planetary atmosphere basics	Ch 9.1 & 9.2	Ch 10.1 & 10.2
19	W Oct 4	The atmospheres of Venus, Mars, and Earth	Ch 10.1 & 10.2	Ch 10.4–10.6
20	F Oct 6	In-class lab and group work: Earth's atmosphere	Ch 10.4–10.6	
21	M Oct 9	Jovian planets and the search for life in the solar system	Lab work	Ch 11.1

22	W Oct 11	Pluto and the outer solar system	Ch 11.1	Ch 11.2, 11.3, 12.1, 12.4
23	F Oct 13	Exoplanets	Ch 11.2, 11.3, 12.1, 12.4	Ch 13.1, 13.2
24	M Oct 16	The Sun as a star	Ch 13.1, 13.2	Ch 14.1–14.3
25	W Oct 18	Different types of stars and the H-R diagram	Ch 14.1–14.3	Ch 15.1 & 15.2
26	F Oct 20	In-class lab and group work: The H-R diagram	Ch 15.1 & 15.2	
27	M Oct 23	The lives of stars	Lab work	Ch 17.1–17.3
28	W Oct 25	White dwarfs, neutron stars, and black holes	Ch 17.1–17.3	Ch 18.1 & 18.2
29	F Oct 27	Black holes	Ch 18.1 & 18.2	Ch 18.3 & 18.4
30	M Oct 30	Exam 2 Review	Ch 18.3 & 18.4	Exam 2 goes live after class
31	W Nov 1	EXAM 2: Stars and planets, Chapters 7–18	No class, remember to take the exam!	
32	F Nov 3	In-class lab and group work: The shape of the Milky Way galaxy	Exam 2 closes at start of class	Ch 19.1 & 19.2
33	M Nov 6	The history and evolution of the Milky Way	Ch 19.1 & 19.2	Ch 19.3 & 19.4
34	W Nov 8	Types of galaxies	Ch 19.3 & 19.4	Ch 20.1
35	F Nov 10	Distance to other galaxies and the age of the universe	Ch 20.1	Ch 20.2 & 20.3
36	M Nov 13	Galaxy evolution	Ch 20.2 & 20.3	Ch 21.1 & 21.2
37	W Nov 15	The Big Bang Theory	Ch 21.1 & 21.2	Ch 22.1 & 22.2
38	F Nov 17	The cosmic microwave background	Ch 22.1 & 22.2	Ch 22.3 & 22.4
39	M Nov 27	Dark matter	Ch 22.3 & 22.4	Ch 23.1–23.3
40	W Nov 29	Dark energy and the fate of the universe	Ch 23.1–23.3	Ch 23.4
41	F Dec 1	Life in the universe	Ch 23.4	Ch 24.1–24.5
42	M Dec 4	Exam 3 Review	Ch 24.1–24.5	Exam 3 goes live after class
		EXAM 3: Galaxies and cosmology, Chapters 19–24 Exam 3 closes at 1 PM on December 8	No class, remember to take the exam!	