

☆ ★ **AST 307 – SPRING 2023 (47875)** ☆
☆ **INTRODUCTORY ASTRONOMY** ☆
PROF. DINERSTEIN (TuTh 9:30 AM)

Class Meetings: TuTh 9:30-10:45 AM in Welch 2.110

Instructor: Prof. Harriet Dinerstein (she/her)

Contact Info: send email via Canvas mail

Office Hours: To be posted; also by prior appointment; sometimes by Zoom

Teaching Assistant (TA): redacted

Office Hours and Location: To be announced

Undergraduate Learning Assistant (ULA): redacted

Contacting your TA and ULA: Please send messages via Canvas mail

Help Sessions: Selected weeks at times to be announced

Caveat: Your instructor has not used Mastering Astronomy previously, so please be patient with her! The TA or ULA may be better prepared to answer questions relating to Mastering.

CATALOG DESCRIPTION: “Introduction to astronomy for **science and engineering students**. The solar system, stars, galaxies, cosmology. Prerequisite: Math 305G or equivalent or consent of instructor; high school trig and physics are recommended. May be counted toward the Quantitative Reasoning flag requirement.”

INSTRUCTOR’S COURSE DESCRIPTION: Ast 307 presents an overview of our modern understanding of the Universe in which we live, and of the methods used to learn the nature of its denizens: the planets, stars, nebulae, and galaxies that inhabit it. We will utilize class time for addressing problems and holding discussions in small groups, taking advantage of the design of our “interactive” classroom. In view of this approach, *regular attendance* and *meaningful participation* in class activities will be a major component of your course grade. Skipping class and hoping to get credit for this course through exams alone will be (literally) a failing strategy!

QR FLAG AND PREREQUISITE: Ast 307 fulfills the **Quantitative Reasoning flag**, which requires that *more than half the course grade be based on the use of quantitative skills to address, analyze, and answer realistic questions in the subject discipline*. Ast 307 provides a more mathematical alternative to Ast 301, the survey course designed for non-science majors. Ast 307 is an approved elective for many majors in natural sciences or engineering, and is a required course for the Astronomy Major as well as prerequisite for some upper-division Astronomy classes, but any UT student may take it if they feel prepared for its mathematical rigor.

The catalog prerequisite is Math 305G: Preparation for Calculus or the equivalent, such as high school pre-calculus. In practice AST 307 will make extensive use of scientific notation, logarithms, trigonometry, proportionalities, and formulas. We will, however, assign some online “tutorials” to refresh these topics for you.

LEARNING OUTCOMES. By the end of this course, you should be able to:

1. Predict positions of objects in the sky as seen from different locations and times.
2. Read and interpret the messages carried by electromagnetic radiation (aka “light”).
3. Define the properties of stars, planets, and galaxies; outline and apply the methods used to measure them; and explain the principles underlying these methods.
4. Explain how stars produce their luminosities and synthesize elements over their life spans, including final stages and end states.
5. Describe the arrangement, hierarchy, and relationships of constituents of the universe including galaxies, larger structures, and dark matter.
6. Relate conditions in the early universe to observations we make today and summarize our current picture of its past, present, and future.

METHODS AND SKILLS TO BE EMPLOYED. To achieve these outcomes, you will:

1. Perform calculations on large and small numbers, convert units, and make estimates.
2. Select and apply appropriate strategies to answer numerical problems.
3. Present and explain the steps of a calculation and comment on the results.
4. Work effectively and supportively in groups to solve problems and explore concepts.

TEXTS, MATERIALS, AND COMMUNICATIONS:

1. You are required to have access to Pearson’s **Modified Mastering Astronomy** package of online tutorials, homework questions, self-study tools, and other resources, which is **bundled with the ebook** version of *The Cosmic Perspective, 9th ed.* by Bennett, et al. This is available to you through the UT Coop’s LTA (Longhorn Textbook Access) program for a heavily discounted cost of \$60.67 plus tax. You will be signed up automatically, will be able to access the materials through Canvas, and be billed after classes begin (<https://www.universitycoop.com/longhorn-textbook-access#undefined>).

In effect, you have free access for the first two weeks of the semester, but you will need to pay the fee (it will be added to your tuition) in order to maintain access until the end of the semester. Optional: If you would like to supplement this with a physical copy, you can order an unbound (loose-leaf) version for a modest cost (about \$40), during or at the end of the semester, or purchase a used copy of a recent edition separately.

2. You will need a **calculator that can perform scientific operations** and does not have WiFi capability or Internet access. You should bring this to each class meeting, as well as to exams. You will also need a **computer** to use for accessing the eText and the Mastering app; if you have a laptop, it may be useful to bring it to class on certain days.

3. You will also need at least one **dry-erase marker** to write on whiteboards in the classroom (includes the table tops!). If you enjoy varying the colors, get a small set.

4. The instructor **will post class slides and useful links** on Canvas. Be sure to set your Canvas **Notifications** to enable immediate posting of Announcements, which is a major means of communication for this class! For email communications, use Canvas mail.

COURSE MODALITY AND FORMAT: This is a “face-to-face” or **in-person** class. Since we anticipate that a good deal of the learning will happen in class, it is critically important that you not miss class unless it is truly necessary. However, if you feel ill or test positive for COVID-19, please stay home, and notify the Instructor by Canvas mail. In case of severe or longer-term illness, contact Student Emergency Services (more information on p. 7); SES should also be notified in case of other emergencies. In recognition of the precarious times we live in, you may miss up to 4 (non-exam) class meetings without losing activity or participation credit. If you have more absences than this, reliable documentation will be required in order to avoid credit penalties. It will not be possible to do a missed in-class activity for credit afterwards, since usually the answer will already have been announced, but it may be useful to work through it for practice.

Most class sessions will feature activities and worksheets that explore concepts and provide practice in problem solving. Bring your calculator to all class meetings, since most activities will include computations. Most in-class activities will be conducted by groups of about 3 to 6 students, depending on the activity, and will conclude turning in group-completed write-ups, which will be graded with most of the credit offered for any reasonable attempt. The initial set of groups may be self-selected, but we will rotate group assignments during the semester to optimize interactions within the class.

Special Note: We will have several guest speakers come and teach a portion of a class meeting, during the last few weeks of the semester. They are graduate students taking a course on Teaching Astronomy, and will add variety and innovation to our course!

GRADING BASIS:

My philosophy is that grades should be based on each student’s effort and achievement, not forced onto a curve that restricts the fraction of particular grades. *There will be no quotas* on A’s and B’s, so helping other students doesn’t hurt your grade but rather improves things for your group and other classmates, enabling us to cover more interesting material. Sincere, meaningful involvement in activities, not simply attendance, is required. Coming late or leaving early is disruptive and can detract from your “participation” credit. Students who skip class often cannot do well in this course.

We will use plus/minus letter grades. The table of numerical score-to-letter-grade correspondences is shown below (most of the bars are set a bit lower than conventional values). The activities earn credit on a points system. To allow for a small number of absences due to factors beyond your control (e.g. illness, emergencies, etc.) we will “forgive” 20% of the total available activity points, a practice I call “overbooking.” However, missing more than four class meetings will constitute excessive absences and lead to loss of credit (unless due to legitimate, documented causes). Grades will be posted periodically on Canvas or Mastering, but feedback on content will mainly be presented collectively, for example through posted files or in class.

Letter Grade to Numerical Score Correspondences (**no rounding up**):

A	A ⁻	B ⁺	B	B ⁻	C ⁺	C	C ⁻	D	F
≥ 90.00	87.00- 89.99	84.00- 86.99	80.00- 83.99	77.00- 79.99	74.00- 76.99	70.00- 73.99	67.00- 69.99	60.00- 66.99	≤ 59.99

WE WANT YOU TO SUCCEED IN THIS COURSE!

Our goal is for you to do well in and, we hope enjoy, this course. To make that happen, we encourage you to ask questions at appropriate times in class, during office hours, help sessions, and by Canvas email. We are here to help you understand and learn.

CLASSWORK AND CREDIT BREAKDOWN:

Unit Exams: 42%. Three closed-book, in-class exams of equal weight, each worth 14%. Varied format, e.g. multiple-choice, fill-in blanks, T/F, short essays, and calculations.

Bring a calculator, since we do not have extras to lend to students. Equations and values of constants will be provided, so you will not need to memorize them.

Probable exam dates: **February 9, March 9** (Thurs. before spring break), **April 13.** If any of these are missed, your make-up exam will be given on **April 20.** In class that day we will offer make-up exams for each of Exam 1, 2, and 3. You can take only one of them, but there will not be a comprehensive exam covering the whole semester, so you will have only a limited amount of material to study. You may take a make-up exam even if you did not miss a previous exam, but want to try to improve on a previous score. Make-up exams count **only** if they help your grade! I have a strict policy that students cannot take exams earlier or later than the rest of the class, unproctored, or at a different location (other than the Testing Center), so please don't ask; there are no exceptions.

Since the seating arrangement in our classroom is not well suited for exams to be taken for individual grades, we will probably take exams in shifts. If you are certified to receive additional time on exams, we may be able to accommodate it in our classroom; however, if that is not a satisfactory solution, you will need arrange to take the exam through the Testing Center of the Diversity and Access office (formerly SSD, Services for Students with Disabilities). However, you must take the exam during the class period.

Quizzes and Practice Exams: 8%. Since the style and format of the exams may be somewhat different from the online homework, there will be a "Practice Exam" before Exam 1, with a component of group work. There may also be some short quizzes to provide extra practice. Like the activities, we will "overbook" these (p. 3) by 20%.

In-Class Activities: 25%. A substantial fraction of class time will be devoted to group exercises. Credit granted will be based on write-ups and productive interactions within groups. Full credit is not automatic, but we will grade generously. We expect that all members of each group will contribute in meaningful ways. If you miss just a few of these activities it will not hurt your grade, but you cannot receive credit for completing them later on your own although you may benefit from doing them in preparation for exams. If you miss more than four classes or activities, some credit may be lost.

Participation: 5%. Missing more than four classes without legitimate reasons and appropriate documentation (hint: a notice from SES) will lead to loss of credit.

On-line Homework: 20% It is a general rule of thumb that you should spend about 3 times as much time outside a class studying the course material, as the class time. That would amount to 9 hours per week for this 3-credit-hour course. Some of that will be structured time on assignments on Mastering Astronomy. These assignments will typically involve watching short tutorials that go over a topic and then answering some questions on that material; we may also assign some of the end-of-chapter problems.

Extra Credit: We will offer up to 2 points of extra credit to students who attend Star Parties organized by UT Astronomy on most Wednesday, Friday, and Saturday nights during the semester. You will need to obtain a signed Star Party slip from the person in charge to earn credit for attending a Star Party. Note that Star Parties take place only when the sky is sufficiently clear and you cannot earn credit if one is canceled due to weather, so don't wait until the end of the semester! There may be other opportunities to earn credit including, most likely, a public lecture on the afternoon of Sat., Feb. 25.

CLASSROOM PROTOCOLS AND POLICIES:

Class Climate: We want all students in this course to feel welcome and respected in our classroom. Students come to UT with a variety of backgrounds, lifestyles, and life experiences, which we value as enriching for our class environment and perspectives. We expect respectful behavior from everyone towards the instructor, TAs, and your classmates. Appropriate behavior has many aspects, including listening patiently to the opinions of other students even if you disagree; briefly holding back answers you know (see "30-Second Thinks") to give others an opportunity to think about questions for themselves; and refraining from distracting activities such as talking or texting on phones, using devices for browsing unrelated to class activities, social media, etc. Studies have shown that such activities adversely affect the grades of other students as well as yourself. Please **turn off** notifications that produce sounds on cell phones. (You may put your phone on vibrate for essential calls, and take them outside the classroom.)

It is the policy of the University of Texas at Austin to maintain an educational environment where all students are free from harassment and intimidation. The College of Natural Sciences in particular is promoting the motto "You belong here." See *University Resources* below to find out where to turn if you are feeling uncomfortable.

The format of this course, including self-study online assignments and in-class group activities, places a heavy responsibility on you to take charge of your own learning. We are using these approaches because they have been shown to be more effective than more passive teaching methods. Group activities that earn considerable credit for participation and effort provide low-stakes opportunities to engage with and master difficult material. However, you should avoid letting members of the group with more background do the work for you: insist on mastering the ideas and methods yourself! The purpose of these activities is learning, not numbers. Pulling answers out of the air (or off the internet) will earn no credit unless your group demonstrates in the write-ups how the answer was obtained by showing intermediate steps and explaining the reasoning.

"30-SECOND THINKS": The instructor may toss out questions in class. Sometimes the intent will be to stimulate immediate dialogue ("call and response") between instructor and class, but at other times the questions are intended to stimulate thought and in some cases discussion within your groups, rather than to obtain an instant answer. When one student calls out an answer immediately, it may deprive other students of the opportunity to come up with their own answers. The instructor will identify "30-SECOND THINK" questions verbally and they will often be indicated in bold red font on the slides. After a pause to allow students whose attention may have drifted off topic to collect their thoughts, we will call for answers.

COVID-19 and Classroom Safety: We are glad to be past the time of acute danger from COVID-19 and its worst impact on university classes, but it still remains an unpredictable concern especially for some individuals, and social distancing is not feasible given the classroom layout and interactive nature of the in-class activities. Anyone who feels uncomfortable attending without a mask is welcome to wear one (your instructor will likely be wearing a mask). Please be considerate of others, no matter what their choices are regarding masks. As noted at the top of p. 3, if you are ill or test positive, please do not come to class, but do alert the instructor that you are absent due to an illness (you need not specify details).

For more information about campus guidelines and resources, see <https://www.healthyhorns.utexas.edu/coronavirus.html> .

UNIVERSITY POLICIES

Accommodations for Disabilities: UT is committed to creating an accessible and inclusive learning environment for all students consistent with university policy and federal and state law. Please let the instructor know if you experience any barriers to learning so we can work with you to ensure that you can participate fully in this course.

If you have a disability or think you may have one, and need accommodations, please contact Disability & Access (D&A), previously known as Services for Students with Disabilities (SSD), at <http://diversity.utexas.edu/disability/>. Keep in mind that students must be recertified every semester. Once you receive your Accommodation letter, it is **the student's responsibility** to contact the instructor *as soon as possible* and arrange to meet with her privately to discuss your situation and needs. Our class design already incorporates some frequent accommodations, but all students with Accommodation Letters must still meet with the instructor in order to initiate any additional actions.

Religious Holidays: If you will miss a class or be unable to meet a course requirement due to a schedule conflict with observance of a religious holiday, please let the instructor know as soon as possible (at least two weeks in advance). You will not be penalized for this as long as you do not have excessive absences, but will still be responsible for material covered in class. Missed activity credit (which is earned with groups and in class) and exams will be made up through our “overbooking” and make-up exam policies. Extensions for online homework may be possible (discuss with the instructor).

Academic Conduct/Scholastic Integrity: The University of Texas at Austin holds its students and community to high standards of academic integrity. You are expected to abide by the University of Texas Honor Code: “As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity.” Copying or presenting someone else’s work as your own, or colluding on assignments, quizzes, and tasks for which this is not allowed constitutes academic dishonesty. It is unacceptable, and subject to academic disciplinary action including possible failure in the course. Even close paraphrases of other people’s responses are plagiarism or copying numerical work with deliberate slight variations is not permissible. See <https://deanofstudents.utexas.edu/conduct/standardsconduct.php>.

Sharing of Course Materials is Forbidden: Materials from this class including, but not limited to Instructor's Notes, class slides, assignments, quizzes, recordings, etc., **may not be shared or distributed** online or outside the class members unless you have explicit written permission of the instructor. (You may share your own notes with classmates, and they will have access to the same materials as you do through Canvas and Mastering.) Unauthorized sharing of materials is academic dishonesty and a violation of the University's Honor Code (above). We are aware that unauthorized academic materials are posted on certain websites; if any of this course's materials are found there and are associated with you, it will be reported to the Office of the Dean of Students and may have serious academic consequences.

PRIMARY UNIVERSITY RESOURCES:

University Health Services (UHS): UHS is an on-campus medical facility providing high-quality medical care and patient education to UT students. Services include general medicine, specialty clinics including gynecology, sports medicine, nutrition, allergy, immunization, travel health and physical therapy, urgent care, 24/7 nurse advice line, and lab and radiology services. Visit healthyhorns.utexas.edu or call 512-471-4955.

Counseling and Mental Health Center (CMHC): If you are experiencing stress, anxiety, depression, academic concern, loneliness, difficulty sleeping, or any other concern impacting your well-being, you are strongly encouraged to connect with CMHC. CMHC is located on campus and provides a wide variety of mental health services to UT students including crisis services, counseling services with immediate support, and well-being resources. Additionally, CARE Counselors are located within each academic school and college. For more information, visit cmhc.utexas.edu or call 512-471-3515.

Where to Turn in Case of Emergencies (SES): If you experience hardships such as illness, accident, or family crisis, etc. please contact Student Emergency Services (SES) (phone: (512) 471-5017, email: studentemergency@austin.utexas.edu). SES will send an official notice that an emergency exists (but will not communicate its nature) to all of your instructors, but only on weekdays. We recommend that you also send a message to the instructor (via Canvas mail), in which case we may be able to start considering ways to address an absence sooner than receiving the SES notification.

Where to turn in Case of Behavior Concerns: BCCAL. If you are concerned about the behavior of someone in our university community, you can call the Behavior Concerns and COVID-19 Advice Line. Reasons for doing so could be that you are worried about a student in your class, bothered that your roommate has been acting differently, or concerned about the behavior of a co-worker? Reach BCCAL by calling (512-232-5050) or online from a link at <https://deanofstudents.utexas.edu/emergency/> . There are options for reporting your concerns anonymously. You can also ask questions on a separate online form regarding community policy relating to COVID-19.

If there is an immediate threat to yourself, others, or property, contact the University of Texas Police Department (UTPD) by calling 911.

Additional information on managing illness, Title IX, and emergency/safety issues is posted in the Supplement to the Syllabus in the General Information module on Canvas.

UNIVERSITY CALENDAR FOR SPRING 2023:

First meeting of Ast 307: **Tues., Jan. 10**

Last day of free add/drop period: **Thurs., Jan. 12** (4th class day)

Class and Staff Holiday: **Mon., Jan. 16** (MLK Day)

Last day for late adds of Ast 307 through the Astronomy Student Office: **Tues., Jan. 17**
(to add, you must attend class that day and identify yourself to the instructor)

Last day to drop a class without need for permission: **Wed. Jan. 25**

Spring Break: **Mar. 13 – 18** (no classes **Mar. 14** and **Mar. 16**)

Last day to drop a class except for urgent *non-academic* reasons; also last day to
change between letter-grade and pass/fail grading basis: **Tues., Mar. 21**

Last class meeting: **Thurs., Apr. 20** (make-up exam day)

PRELIMINARY SCHEDULE (Dates and detailed readings subject to change)

Lesson	Topics	Date	Reading: chs.
1	Course Introduction and Approach	1/10	1.1, 1.3
2	Angular Measure, Locating Objects in the Sky	1/12	2.1
3	Motions and Cycles of the Sky	1/17	2.2, S1.2
4	Coordinate Transformations and Lunar Phases	1/19	2.3
5	Historical Astronomy from Ptolemy to Kepler	1/24	2.4, 3.2, 3.3, S1.1
6	Newton's Laws, Energy, Conservation Laws	1/26	4.1-4.3
7	Newtonian Gravity, Masses from Orbits	1/31	4.4, 4.5
8	Basics of Light, Thermal Radiation	2/2	5.1, 5.2, 5.4
9	Spectral Lines and what they tell us	2/7	5.3, 5.4
	EXAM 1 on Lessons 1-7	2/9	Lessons 1-7
10	Telescopes and Observing Techniques	2/14	6 (whole chapter)
11	Our Neighbor Star, the Sun	2/16	14.1, 14.2
12	The Measures of Stars, HR Diagram, clusters	2/21	15.1, 15.2, 15.3
13	Lives of Low-Mass Stars, brown & white dwarfs	2/23	16.3, 17.1, 17.2, 17.4
14	Lives of High-Mass Stars, SNe, neutron stars	2/28	17.3, 18.1, 18.2
15	General Relativity and Black Holes	3/2	S3.1, S3.3, 18.3
16	Gravitational Waves and LIGO	3/7	18.4
	EXAM 2 on Lessons 8-15	3/9	
17	Overview and Formation of our Solar System	3/22	7.1-.2, 8.1-.2, 10.1-2, 12.1, 12.3, 12.4
18	Planets around other Stars ("exoplanets")	3/24	13 (whole chapter)
19	Our Galaxy, the Milky Way	3/28	19 "
20	Beyond the Milky Way, Hubble's Law	3/30	20 "
21	The Early Universe (Big Bang and after)	4/4	22 "
22	Dark Matter, Dark Energy, and the Future	4/6	23 "
23	Galaxy Formation, Evolution, and Assembly	4/11	21 "
	EXAM 3 on Lessons 16-23	4/13	
24	Topics by Request, Careers in Astronomy	4/18	
	MAKE-UP EXAMS (Optional)	4/20	