

AST 307 - Introductory Astronomy

Fall 2021 - Unique No. 48280

TTh 11am – 12:30pm @ WEL 2.246

Zoom link: <https://utexas.zoom.us/j/98776896005>

Instructor: Prof. Caitlin Casey

Office: PMA 16.218

Phone: (512) 471-3405

Email: cmcasey@utexas.edu

Office Hours: TBD (to be posted on canvas)

Teaching Assistant: Khalid Osman

Office: ECJ 5.200

Email: kosman@utexas.edu

Office Hours: TBD (to be posted on canvas)

Course Description: This course provides an overview of modern astronomy and astrophysics for science and engineering majors, including astronomy majors. We cover topics from how to measure the night sky, the formation and detection of planets, stellar evolution, galaxies across cosmic time, to the scale and history of the Universe from the Big Bang until the present day. We will also take a look at the historical context of some of the most important astronomical discoveries, from ancient to modern astrophysics. Intermixed with lectures, our course will incorporate techniques from an inquiry-based approach to learning, including group activities, critical thinking exercises, and open ended analysis. The purpose of this approach is to introduce students to the methodology used by real scientists to solve real astrophysical problems.

Course-Level Learning Outcomes: After taking this course, you should be able to:

- Describe the primary ways that light interacts with matter,
- Derive basic physical quantities for astronomical objects from observables,
- Apply basic gravitational arguments to interpret bodies in orbital motion,
- Describe the major evolutionary stages of astronomical objects (including planets, stars, galaxies, and the Universe),
- Contrast the spatial, distance, and mass scales of astronomical objects, from black holes, planets, stars, planetary systems, star clusters, galaxies, and galaxy clusters,
- Explain the basic steps needed to obtain observational data with a telescope,
- Draw an astronomical problem and describe its components,
- Check the units of a solution to verify that they are correct,
- Demonstrate teamwork by working collaboratively to complete in-class assignments, ensuring all members of the group are heard and are active, and
- Present the steps of a calculation to peers and discuss the scientific reasoning that justifies these steps.

Pre-requisites and Core Requirements: No formal pre-requisite is required for this course, although students should feel comfortable with algebra, dimensional analysis, unit conversion, geometry and pre-calculus concepts including trigonometry. The course relies on knowledge of these concepts and they will not be reviewed during our lectures. This course is intended to be more mathematically rigorous than AST 301, a course which covers very similar material but not at as great a depth and not as quantitatively.

This course carries the Quantitative Reasoning flag. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore

expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.

Texts and Materials:

- REQUIRED: One dry erase marker for in-class activities for in person mode
- REQUIRED: Access to *Modified Mastering Astronomy* standalone access or often sold as a bundle with the Cosmic Perspective eText or physical book (see Canvas for more detailed instructions)
- OPTIONAL: *The Cosmic Perspective*, 9th Edition. Bennett, Donahue, Schneider & Voit. You are free to use an earlier version of this text if you prefer (they are cheaper if you want a physical copy). The homework access is often bundled with the eText. The text is completely optional for the course and is not required to succeed.
- NO ACTION REQUIRED: Class notes provided by the instructor via *Canvas* class website
- You will need a non-wifi enabled calculator for exams. It is highly recommended to also bring it to class every day.

You can purchase a Modified Mastering Astronomy many ways: online with an eText rental version of the book for 6 months up to 2 years, or with a physical copy of the book from the bookstore. You need to register for the course through our canvas course website, by clicking on the “MyLab and Mastering” tab on the left, and proceed via the yellow button “Open MyLab & Mastering.” The browser you use to access the homework will need to allow pop ups. For reference, our course ID is **casey76716**, although you shouldn’t need it when accessing the course via canvas. Note that you may be granted temporary free access to Modified Mastering Astronomy that expires after the first two weeks of the semester, so make plans to purchase access if you are planning on completing this course.

Classroom Safety and COVID-19: This is a science classroom and we are strongly recommending that we look to the science and follow the guidance of local public health officials and the Center for Disease Control and Prevention (CDC). Wearing a mask indoors is strongly encouraged, even if you are vaccinated, especially while Austin is in Stages 3 or higher. Masks efficiently reduce the spread of COVID-19. To help preserve our in person learning environment, the university recommends the following:

- Adhere to university mask guidance and follow the recommendations of the CDC. Our class will be the most successful if we all protect and respect each other and wear a mask.
- Vaccinations are widely available, free and not billed to health insurance. The vaccine will help protect against the transmission of the virus to others and reduce serious symptoms in those who are vaccinated. The vaccines are safe, and effectively prevent against severe illness from COVID-19.
- If you are experiencing any symptoms of COVID-19, please follow university guidelines here: https://healthyhorns.utexas.edu/coronavirus_exposure_action_chart.html, including getting tested. If you test positive, you should isolate yourself at home. Contact the Behavior Concerns and COVID-19 Advice Line (BCCAL) to report your positive result. BCCAL can also assist you with isolation options, class absence notification or other support. and if you find out that you have a positive test for COVID-19.
- **If you are experiencing any symptoms of COVID-19 — or ANY suspected illness — do not come to class in person.** If you are well enough to attend via zoom, please do. Zoom will be offered as an option throughout the semester. If not, you can use one of your three drops.

- Proactive Community Testing remains an important part of the university's efforts to protect our community. Tests are fast and free, and I recommend testing at least once weekly.
- Visit protect.utexas.edu for more information.

Class Structure: This class will combine short lectures with discussions and group activities. It will not be a traditional University lecture course. You will only learn if you participate in class activities, thus attendance and participation — either in person or online — is *required*. Do not pack up or leave class early or come late unless you have talked to me in advance, as a consideration to both me and your fellow students.

Special note regarding COVID: Class will be offered in hybrid mode for the duration of the semester, and if you feel ill in any way you are encouraged to attend via zoom and not in person. Classes held before September 17 will be held on zoom.

Class Website and email: The class website is hosted on Canvas and should be checked regularly for updates and messages from me regarding exam review sessions, course materials, or special events. In addition to the class website, email is recognized as an official mode of university correspondence, so you are responsible for reading your email for university course-related information, and canvas-delivered announcements. Please check your email regularly and frequently and make sure you are set to receive notifications from Canvas as appropriate.

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 feel free to contact me to discuss reasonable accommodations for your access needs. Students with disabilities may also request appropriate accommodations from the Division of Diversity and Community Engagement, and from UT's Services for Students with Disabilities. The official wording provided by the university is: The University of Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-6441 TTY or Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259, www.utexas.edu/diversity/ddce/ssd.

I recognize that students with children or family care responsibilities might require special accommodations on occasion. Students with a gap in childcare are invited to attend the lecture via zoom and they should feel free to contact the instructor regarding missed or late work.

Grading Components and Policies: You will receive the grade you earn in this course. There will be no extra credit awarded after the final class period of the semester, so please be sure to put in your best effort throughout the semester to earn the grade you would like. Your final grade will be composed of the following elements:

- Exams = 30%
- Online homework = 40%
- In-class Participation = 15%
- In-class Group Assignments = 15%

Here is more information on each of the grade components:

Exams: There will be three closed-notes, closed-book exams covering material discussed in class, as outlined in the class schedule. (The format of the exams may be changed for the

safety of everyone in the class, and you will be notified well in advance if this is the case.) These exams will be held **during class** and are scheduled for **September 23rd, October 26th, and November 30th**. If you have a legitimate and unavoidable conflict with these exam times (University related conflict or religious holiday), let the instructor know via email at least 14 days before the exam date so that accommodations can be made; in the case of illness or emergency let the instructor know at earliest convenience. There will be no opportunity for after-the-fact make-up exams.

There will be an OPTIONAL final exam held during the University pre-scheduled time for our course, **Friday, December 10, 9:00 am-12:00 pm**. The final exam is available to anyone who would like to replace their lowest test score with this cumulative, multiple-choice exam; it will only be able to improve your grade.

Homework: Online homework will be assigned ten times in the semester (roughly on a weekly basis) through “Modified Mastering Astronomy” which you can access via the “MyLab and Mastering” Tab on our Canvas page. The homework will generally be due at 10am on Thursdays (an hour before class time), but is subject to change for any given assignment; ample notice will be given if such a change is made. It is your responsibility to keep track of due dates in Mastering Astronomy. The system will automatically cut off access to the homework at the designated due date and time. No late credit will be given but you will still be able to complete the assignment for practice. Each homework assignment is worth a different number of points depending on length and difficulty, and at the end of the semester those points are added together to form your overall homework grade. The equivalent of one homework assignment (average point value thereof) will be forgiven at the end of the semester. Group work and discussion is allowed (and encouraged) for homework assignments, but each student must be responsible for their own understanding of the material from each assignment and independently complete the work.

Class Participation: In-class participation is a significant component of this class, and thus your grade; this holds whether or not the class stays on zoom or in person. If we resume in person classes, there will always be an option to attend class online to earn your participation credit if you find yourself ill. You will carry out many group discussions and in-class activities with a set group and, when attending class in person, you will have an assigned seating arrangement for the purposes of contact tracing (taking special accommodation requests into consideration). Your attendance will be recorded every single class period by the TA. If you are late or leave early (more than 10 minutes) you will only receive half participation credit for the day, unless you have discussed a special reason to excuse your tardiness or early departure with the TA beforehand. You can miss three class periods without it affecting your attendance grade.

In-class Group Assignments: Specific in-class activities (that are advertised as G.A.’s = Group Assignments) will be graded for accuracy of submitted answers and work shown. Your assigned group will receive a set grade for each Group Assignment and all Group Assignments will be worth the same number of points. There will be approximately five G.A.’s over the course of the semester. If a Group Assignment is not finished in class the group can meet to complete it outside of class (preferably on zoom) and turn in the work during the next class period. If group members are missing or we determine that a group dynamic is unhealthy, disrespectful, unengaged, or inequitable, this can impact your In-class Group Assignment score. If a group dynamic is causing harm to your learning, please notify both the instructor and TA immediately so we may make adjustments.

Grades: This class will *not* be graded on a curve. Your grade is calculated to the nearest 1/100th of a percentage point. The average percentage in each of the above grade components will be weighted by the indicated percentage to derive the final course grade, assigned as follows:

93.00—100% = A	80.00 — 82.99% = B-	67.00 — 69.99% = D+
90.00 — 92.99% = A-	77.00 — 79.99% = C+	63.00 — 66.99% = D
87.00 — 89.99% = B+	73.00 — 76.99% = C	60.00 — 62.99% = D-
83.00 — 86.99% = B	70.00 — 72.99% = C-	0 — 59.99% = F

Regarding harassment/assault: Harassment of any sort will not be tolerated in this classroom or related workspaces. Title IX and Title VII makes clear that violence and harassment based on sex, gender, race or national origin are Civil Rights violations subject to investigation and disciplinary action on behalf of the University. The same kinds of accountability and support will be applied to offenses against other categories such as sexual orientation and gender identity. If you or someone you know has been harassed or assaulted, either in the classroom or outside of the classroom space, you can find the appropriate resources through the University Title IX Coordinator (512-232-3992), 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).

Mental Health Services: College life can be challenging and stressful. We are also in the midst of a multi-year pandemic. Diminished mental health, including significant stress, mood changes, excessive worry, or problems with eating and/or sleeping can interfere with optimal academic performance. Similarly, problems with relationships, family worries, loss, or a personal struggle or crisis can also contribute to decreased academic performance. UT Austin's Counseling and Mental Health Center (<https://cmhc.utexas.edu>; 512-471-3515) provides mental health services to support the academic success of students. This includes counseling services, wellness workshops, free and confidential therapy groups, and general information. I encourage you to browse their website and actively seek support if you're experiencing any of these difficulties.

Diversity, Equity, and Inclusion: Astronomy belongs to all people, independent of race, religion, gender, gender identity, gender expression, or sexual orientation. Incidents of discrimination, assault, harassment, threats, intimidation, profiling, or coercion based on membership or perceived membership will not be tolerated.

Academic Dishonesty: The minimum penalty for cheating — in any way whatsoever — is receiving a zero on the assignment on which you cheated. The instructor reserves the right to seek a penalty the instructor deems appropriate for the given case of academic dishonesty, including failing the class and being reported to Student Judicial Services. In this class, in addition to all the traditional types of cheating (looking at someone else's answer, utilizing "cheat sheets" of any form or fashion either paper or digitized, getting an advance copy of an assessment), we also consider allowing someone else to use your Mastering Astronomy account cheating. If the academic honesty is sufficiently serious, the instructor will proceed by filing a formal report to the Judicial Services in the Dean of Students Office as is policy. Judicial Services would decide the final penalty after a hearing on the matter. For more information, read in the General Information Catalog about scholastic dishonesty (i.e. cheating).

Drop date: The last day to drop the class is October 28th. This will require you to go to your college and get a drop form. You then must bring the form to me and get my approval and signature. After this deadline, students must go to the Dean's office, WCH 2.112, to begin the appeal for substantiated non-academic reasons. The last day to drop with the possibility of a refund is September 10th.

Class Material and Schedule: Below is the approximate course schedule and material we will cover on those days. It is subject to some minor changes.

<u>Class Date</u>	<u>Class Material</u>	<u>Relevant Sections of Textbook</u>
Aug 26	Introduction & Logistics, Scale of Universe	Sec 1.1, 1.2
Aug 31	Geometry of Earth/Moon system	Sec 3.2
Sep 2	Seasons, Moon Phases and Eclipses	Sec 2.2, 2.3, S1.1, S1.2
Sep 7	Measuring flux, angle of incidence	Sec 15.1 (inv sq law only)
Sep 9	Kepler's Laws, "Weighing" planets	Sec 3.3, 4.1–4.4
Sep 14	Telescope Basics Part 1	Sec 6.1, 6.2, 6.3
Sep 16	Telescope Basics Part 2	Sec 6.1, 6.2, 6.3
Sep 21	Basics of light, understanding temperature	Sec 5.1, 5.2
Sep 23	EXAM #1 - FUNDAMENTALS OF ASTRONOMY	NA
Sep 28	thermal radiation, spectra and EM Radiation	Sec 5.4, 5.3
Sep 30	Stars part 1: Magnitudes & Classification	Sec 15.1 (all)
Oct 5	Stars part 2: The Herpsrung-Russell diagram	Sec 15.2
Oct 7	Stars part 3: Structure & Composition	Sec 17.2
Oct 12	Stars part 4: Lives, Deaths, and Afterdeaths	Sec 16.2, 17.3
Oct 14	Stellar binaries & Doppler Effect	Sec 15.1 (stellar mass), 5.4 (doppler effect)
Oct 19	Radial Velocities and Transits	Sec 13.1, 13.2, 13.4
Oct 21	Planet formation theory & Habitability	Sec 8.2, 13.3, 10.1, 24.4
Oct 26	EXAM #2 – STARS & PLANETS	NA
Oct 28	Cosmic Distance Ladder	Sec 15.1 (parallax), 20.2
Nov 2	Shapley/Curtis Debate, and Hubble's Law	Sec 20.2
Nov 4	Big Bang Cosmology	Sec 22.1–22.3
Nov 9	Dark Energy	Sec 23.4
Nov 11	Dark Matter	Sec 23.2

Nov 16	Galaxy Formation & Evolution	Sec 23.3, 21.1, 21.4
Nov 18	Gravitational Lensing	Sec S3.4, 23.3
Nov 23	Supermassive blackholes	Sec 21.3
Nov 30	EXAM #3 – GALAXIES & COSMOLOGY	NA
Dec 2	Astrophysical oddities / Pursuing Science as a Career	NA