

AST 307 - Introductory Astronomy

Spring 2019 - Unique No. 46590
TTh 12:30pm – 2pm @ WEL 2.140

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Course Description: This course provides an overview of modern astronomy and astrophysics for science and engineering majors. We cover topics from our place in the solar system, 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 the same material but not at as great a depth.

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
- REQUIRED: Access to *Modified Mastering Astronomy* standalone access or often sold as a bundle with the Cosmic Perspective
- OPTIONAL: *The Cosmic Perspective*, 8th Edition. Bennett, Donahue, Schneider & Voit. You are free to use an earlier version of this text if you prefer. 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* access code online by itself, online with an electronic copy of the textbook *Cosmic Perspective* bundled, or through the bookstore with a physical access code (this option is going to be the most expensive). The bookstore has told me that they have versions of the *Cosmic Perspective* text in loose-leaf, that also include access to *Modified Mastering Astronomy*. When registering your *Modified Mastering Astronomy* access code choose "Cosmic Perspectives 8th ed" (careful of the correct edition) as the textbook. Our course ID is "**casey28918**" which you enter at registration.

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 a problem and a distraction to others, we will give one warning and then ask you to leave the classroom, not earning participation credit for that day. 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, TA, or LA who will follow-up. Due to the structure of this class space, laptop use is strongly discouraged unless you require it for accommodations or consult with me privately about your needs.

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 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.

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 are welcome to bring their children to class to cover a gap in childcare, and they should feel free to contact the instructor regarding missed or late work. Also, because this course is held over the lunch hour this semester, I understand if you have to eat something during the course but please minimize any disturbance to others.

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 = 40%

Online homework = 30%

In-class Participation = 20%

In-class Group Assignments = 10%

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. These exams will be held **during class** and are scheduled for **February 19th, April 4th, and May 7th**. If you have a legitimate and unavoidable conflict with these exam times (including illness, emergency, 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. There will be no opportunity for last-minute make-up exams, unless there is verified illness or emergency accompanied by a doctor's note.

There will be an **OPTIONAL** final exam held during the University pre-scheduled time for our course, May 21st, 9 am— 12 noon. 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 weekly through "Modified Mastering Astronomy;" please see the class website and MyLab/Mastering Astronomy tab for details on homework due dates and times. The TA will make homework related announcements in class but 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. 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 major component of your grade. You will carry out many group discussions and in-class activities with an assigned group and an assigned seating arrangement (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 two 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 eight G.A.'s over the course of the semester. On rare occasions, if a Group Assignment is not finished in class the group can meet to complete it outside of class 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. 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 dishonesty 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 April 8th. 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 February 6th.

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.

Class Date	Class Material	Relevant Sections of Textbook
Jan 22	Introduction & Logistics, Scale of Universe	Sec 1.1, 1.2
Jan 24	Geometry of Earth/Moon system	Sec 3.2
Jan 29	Seasons, Moon Phases and Eclipses	Sec 2.2, 2.3, S1.1, S1.2
Jan 31	Measuring flux, angle of incidence	Sec 15.1 (inv sq law only)
Feb 5	Kepler's Laws, "Weighing" planets	Sec 3.3, 4.1–4.4
Feb 7	Telescope Basics Part 1	Sec 6.1, 6.2, 6.3
Feb 12	Telescope Basics Part 2	Sec 6.1, 6.2, 6.3
Feb 14	Basics of light, understanding temperature	Sec 5.1, 5.2
FEB 19	EXAM #1 - FUNDAMENTALS OF ASTRONOMY	NA
Feb 21	thermal radiation, spectra and EM Radiation	Sec 5.4, 5.3
Feb 26	Stars part 1: Magnitudes & Classification	Sec 15.1 (all)
Feb 28	Stars part 2: The Herpsprung-Russell diagram	Sec 15.2

Mar 5	Stars part 3: Structure & Composition	Sec 17.2
Mar 7	Stars part 4: Lives, Deaths, and Afterdeaths	Sec 16.2, 17.3
Mar 12	Stellar binaries & Doppler Effect	Sec 15.1 (stellar mass), 5.4 (doppler effect)
Mar 14	Radial Velocities to find planets	Sec 13.1
Mar 18-21	SPRING BREAK	NA
MAR 26	Transits changing our view of planets	Sec 13.2, 13.4
Mar 28	Planet formation theory	Sec 8.2, 13.3
Apr 2	Transmission Spectroscopy and Aliens	Sec 10.1, 24.4
Apr 4	EXAM #2 — STARS & PLANETS	NA
Apr 9	Cosmic Distance Ladder	Sec 15.1 (parallax), 20.2
Apr 11	Shapley/Curtis Debate, and Hubble's Law	Sec 20.2
Apr 16	Big Bang Cosmology	Sec 22.1–22.3
Apr 18	Dark Energy	Sec 23.4
Apr 23	Dark Matter	Sec 23.2
Apr 25	Galaxy Formation & Evolution	Sec 23.3, 21.1, 21.4
Apr 30	Gravitational Lensing / Large Scale Structure	Sec S3.4, 23.3
May 2	Supermassive blackholes and quasars	Sec 21.3
May 7	EXAM #3 — GALAXIES & COSMOLOGY	NA
May 9	Astrophysical oddities / Pursuing Science as a Career	NA