

# AST 352K – STELLAR ASTRONOMY (FALL 2020, 46590)

AUG. 27, 2020

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Course website and email platform for contacting the professor and T.A.: **Canvas**

Class meetings: Tues. & Thur. 12:30-1:45 PM via Zoom (This is a **synchronous online** class.)

Instructor: Prof. Harriet Dinerstein (she/her), PMA 16.324, contact via Canvas email

Teaching Assistant: **REDACTED**

Consulting Hours with the Prof. and T.A.: will be announced and posted

## **DISCLAIMER AND PERSONAL MESSAGE:**

These are challenging times, and it will be an unusual semester for all of us. Your instructor has had only 6 weeks of previous experience teaching online, for a very different type of course (large lecture, taught asynchronously). Here I hope to transfer the synergy of students working in small groups to grapple with material and figure things out together, into the virtual world. I will also be experimenting with some new types of assignments and course protocols. Please be patient as we strive to overcome bumps in the road. In order for us to best help you in this course good communications will be essential, so do let us know if you are having difficulties.

## **COURSE SUBJECT MATTER AND LEVEL:**

Astronomy 352K is an upper-division course on stellar astronomy that approaches the subject from the perspective of *how we obtain and interpret astronomical measurements*. It carries a Quantitative Reasoning flag and is designed for students majoring in astronomy, physics, engineering, or geology. Students with other majors should check that they have the prerequisites before taking this course.

Stars are clearly fundamental to astronomy. They are the ruling bodies of planetary systems, the building blocks of galaxies, and the nuclear ovens where elements heavier than helium are created. We will examine the so-called “observable” properties of stars: characteristics that can be measured even over great distances through the analysis of the light they emit. By applying well-established physical principles, we can deduce stellar surface temperatures, radii, luminosities, composition, masses, and much more. It is amazing how much we can learn from starlight, but we need to appreciate both the power and limitations of these techniques in order to assess what is well-established and what is provisional knowledge. I hope you will enjoy this broad tour of astronomy.

## **PREREQUISITES, COURSE PHILOSOPHY AND OBJECTIVES:**

The prerequisites for Ast 352K are Physics 301 and 316 or the equivalent: two semesters of college level, calculus-based physics. Previous astronomy courses are not required but may be helpful. Since astronomy draws on specialized topics in physics that students may not have encountered, we will introduce them as needed. The chief purpose of the prerequisite is to ensure familiarity with certain physical principles and problem-solving methods. In this course you will mainly be *applying* principles rather than carrying out extensive theoretical derivations. The math used will be mostly at the level of algebra, trigonometry, and simple calculus. We will often make rough estimates: “astronomical accuracy” means knowing a quantity only approximately (sometimes to only a factor of a few). We will use math as a tool to explore and uncover interesting results and relationships. Since our purpose is *not* simply to obtain numbers, but rather to obtain insight, you will be expected to comment on your answers: Are they surprising? What are their significance and implications?

## WHAT WILL I LEARN IN THIS COURSE?

Top-level goal: To master the common terms, metrics, and conceptual bases of observational astronomy and use these tools to infer properties of stars and their origin and life stories. Specific learning outcomes will be stated in the Welcome page for each unit.

## REQUIRED AND RECOMMENDED COURSE RESOURCES:

- **Primary Resource – Instructor’s Notes:** The primary text for Ast 352K is a set of course notes developed jointly by Profs. Harriet Dinerstein and Chris Sneden to be posted in sections, typically a couple of days in advance of being covered in class. These notes are for your personal use **only** and may not be distributed to others (see **University Policies** below).
- **Class Slides** – Additional information, such as extra diagrams, will be presented in slides shown in synchronous class meetings. These will be posted **after** class, ensuring that they correspond to what was displayed and providing an opportunity to add extra material.
- **Supplemental Materials:** Some of the course topics are discussed in books, notably Ostlie & Carroll’s “An Introduction to Modern [Stellar] Astrophysics.” (Versions both with and without the word “Stellar” exist.) This is a useful and popular reference volume for students planning to continue in astronomy. For some topics early in the semester, “Observational Astronomy, 2<sup>nd</sup> edition” by Birney is useful. Selected pages or sections of these books may be posted on Canvas. Other supplemental items may include special diagrams and selected pages from general reference books and links to frequently used databases and other resources.
- **Especially for astronomy novices:** If you have not previously taken an introductory astronomy course you may encounter many unfamiliar terms here. You may consult any reasonably recent introductory textbook, but another option is the free OpenStax book “Astronomy” by Andrew Fraknoi, et al. at <https://openstax.org/details/books/astronomy>. You can download the whole book or sections. Relevant pages will be listed on Canvas.

## EXPECTATIONS, PROTOCOLS, & DISCLOSURES:

There are a number of points to keep in mind in order to participate effectively in this course, mostly associated with its remote-learning format. Among other things, you will need to:

- **Use a laptop** rather than a tablet (iPad) or phone to join class sessions. For example, this enables annotating shared screens and effectively carrying out assignments on Canvas.
- Always **log onto Zoom through Canvas**: sign on to Canvas first, then select the Zoom link on the left menu. This ensures that you are logged in on your official UT Zoom account.
- You will be expected to **keep your video feed live** during class sessions (exceptions for special circumstances). The video feed will also be needed for proctoring during quizzes.
- You may be **muted** some of the time, to keep background noise to a minimum.
- Ensure that your **Notifications** are set so that you receive class **Announcements** promptly, since these will be a primary channel for us to communicate with you.
- Be aware that some portions of class meetings will be **recorded** for archival purposes, although not publicly or generally available without special permission (see p. 6) .
- Reminder: course materials are for your **private academic use only** (see p. 6).

## COURSE ORGANIZATION AND PLANNED SCHEDULE: (SUBJECT TO REVISION!)

Unit No.	Unit Title	Key Topics	Expected Dates	Assignments & tentative quiz dates
1	<i>Where the Stars Are:</i> Positional Astronomy	Reference frames & coordinate systems; diurnal & annual cycles; precession; parallax/distances	8/27, 9/1, 3, 8	HW 1 Quiz 1 (9/17)
2	<i>Seeing the Light:</i> EM Radiation & Spectra	EM spectrum; kinds of spectra; blackbody radiation; magnitude system; filters & colors	9/10, 15, 17, 22	HW 2 Quiz 2 (10/8)
3	<i>Telescopes &amp; Tellurics:</i> Observing Tools, Methods, Constraints	Telescopes; instruments; types of measurements; effects of the atmosphere & back/foregrounds	9/24, 29, 10/1, 6	Group Project
4	<i>Roadmap of the Stars:</i> Stellar Spectral Types & the HR Diagram	Spectral types; luminosity class; color-magnitude & HR diagrams; MS lifetimes & star clusters	10/8, 13, 15	HW 3 Quiz 3 (10/29, on last 2 units)
5	<i>Hiding in the Light:</i> Quantitative Methods	Bohr atom; spectral lines; physical basis of spectral types; abundances of elements	10/20, 22, 29, 11/3, 5	HW 4
6	<i>The Way They Move:</i> Velocities and Orbits	Radial velocity & proper motion; kinematics of stellar populations; binary systems and masses	11/5, 10, 12	HW 5 Quiz 4 (11/19, on last 2 units)
7	<i>Lives of the Stars:</i> Evolution & Endpoints	Pre- and post-Main Sequence Evolution of Low and High-Mass Stars; Remnants & Recycling	11/17, 19, 24, 12/1, 3	Quiz 5 (12/3) HW 6, Indiv. Project (12/7)
	Optional Final Exam	If you missed a quiz or would just like a chance for a “re-do,” this is your make-up chance!	12/10	

You may notice that according to the schedule above there is usually a time lag between a unit and the corresponding quiz. This is deliberate, in order to ensure sufficient time to complete assignments such as homework and receive feedback prior to the unit quiz.

### COURSEWORK AND GRADING BASIS:

Grades will be assigned on a plus/minus scale, based on a “points” system. That is, I do not use a “curve” that limits the number of students who can receive a certain grade, e.g. an A. You will receive a grade based on your performance in the course. That said, note that about a quarter of your grade will come from group activities carried out in class, but most of the credit on these is for completion and effort, and they will be “overbooked” (see below). The breakdown:

- Unit Quizzes:** 5 quizzes, tentative dates listed below, each focusing on just 1 or 2 units. Each is worth 12 points, but the lowest score will be dropped, so the quiz total will make up 48% of the course grade. These will be given synchronously during class, with remote proctoring (method TBD). Rather than having make-ups for specific missed quizzes, the all-purpose quiz make-up opportunity is an optional final exam at the official time of **Thurs., Dec. 10, 9:00 AM**. This make-up option is also available to any student who wants a “re-do” to try to improve their grade.

- **Ungraded on-line quizzes:** No points. Each unit will include one or more “Terms and Concepts Checks” consisting of simple (e.g. multiple-choice) questions that will provide a check on basic knowledge of the material. These are not at as high a level as the graded assignments (homework and quizzes), but are designed as self-study tools.
- **Daily in-class Activities:** We will have small-group activities in the form of worksheets during most class meetings. If you have a scientific calculator, keep it available for both activities and quizzes. Activities **must** be done in groups and during class; *no credit will be given for students who attempt them by themselves or after class*. If an activity is missed, the equivalent credit should be earned on a future activity. There will be a “cap” of 18 points for total activity credit, but more than 18 points will be made available (this is what I mean by “overbooking”). I use this policy for in-person classes as well, to allow for the possibility of a student missing an occasional class (for many valid reasons).
- **Small Projects:** We will have a couple of less-conventional assignments. One will be an extended group project on creating a proposal to build a telescope (up to 6 points). An individual-based project will be a “Stellar Spotlight”: find a recent news story about an interesting star, event, or star-related discovery, and create a short presentation to the class and a write-up to contribute an electronic class “yearbook” (3 points).
- **Homework:** There will be about 6 homework sets. The lowest score will be dropped, for a homework total of up to 15 points. These will essentially serve as practice quizzes. If submitted on time, they may earn up to full credit. If received late but within 24 hours they will earn only 2/3<sup>rd</sup> of the credit, and no papers received after 24 hrs are accepted.
- **General Participation:** The remaining points (10) that bring the total to 100 will come from regular participation as documented by Zoom. Substantive contributions in class and on Canvas Discussions also counts towards general participation.
- **Extra Credit:** There will be some opportunities to earn a small amount of extra credit. These will include doing an extra “Spotlight” contribution, and attending (via Zoom) pre-approved seminars related to course material (credit is based mainly on a write-up).

The intended correspondence of letter grades to numerical scores is as follows, with no rounding up or down. (Adjustments are unlikely, but if made they will be in your favor.)

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- 73.99	70.00- 73.99	67.00- 69.99	60.00- 66.99	≤ 59.99

**IMPORTANT DATES FOR FALL 2020:** (some of these apply to any UT class)

- First class meeting: **Thurs., Aug. 27**
- Last day to add this class (end of free adds/drops period): **Mon., Aug. 31**
- Last day to add any class, or to drop with a possible refund: **Fri., Sep. 11**
- Last day to drop a class for academic reasons (requires dean’s approval) or to change grading basis between a letter grade and credit/no-credit: **Thurs., Oct. 29**
- Last class meeting: **Thurs., Dec. 3**
- Last UT class day, last assignment due: **Mon., Dec. 7**
- Optional final exam (= make-up for previous quizzes): **Thurs., Dec. 10**

## COMMUNICATIONS AND HOW TO GET HELP IN THIS COURSE:

- **Ask questions during synchronous class meetings** – Often the best time to ask a question is when it first arises. And other students may have the very same question! If you are muted, use the chat window to ask questions, or use the “raise hand” feature.
- **Visit during Consulting Hours** - We will schedule several Zoom meetings per week with the instructor and T.A. Whether these will be open or private (one-at-a-time) sessions will depend on which we find works best. You can also request appointments at other times.
- **Email the instructor and T.A.** with questions. It is important that you do this **through Canvas** (not directly to their general email addresses) since this identifies your message as associated with the course. In your message please **indicate exactly to whom it is being addressed**, e.g. Instructor only, T.A.s only, or both, to avoid crossed signals.
- We also plan to create **Discussions** on certain topics including one on questions about course operations, deadlines, etc. This lets other students see questions and responses.
- We want you **to feel comfortable and to succeed** in this course! All participants must exhibit respect, courtesy, and sensitivity toward others in this class. If you prefer to be addressed by a different name or pronoun than those on the class roster, you can indicate this on a survey early in the semester. This will also help us keep track of your work.

## GENERAL RESOURCES FOR STUDENT SUPPORT:

- **University and College of Natural Sciences (CNS) Inclusivity Policies** – The university is committed to creating an accessible and inclusive learning environment for every member of our community. Bias, discrimination, and harassment have no place here. If you have concerns, contact the Campus Climate Response Team at [diversity.utexas.edu/ccrt](https://diversity.utexas.edu/ccrt).
- Other places to turn if you are concerned about safety or the behavior of students, TAs, faculty, etc. are the Behavior Concerns Advice Line, BCAL (512) 232-5050, and BeVocal, [wellnessnetwork.utexas.edu/BeVocal](https://wellnessnetwork.utexas.edu/BeVocal).
- Some students are eligible for certain accommodations on course requirements through authorization by **Services for Students with Disabilities (SSD)**. If you have a disability or think you may have a disability and need accommodations, please contact SSD as soon as possible, since SSD authorizations must be renewed each semester. See SSD’s website at [diversity.utexas.edu/disability/](https://diversity.utexas.edu/disability/) for information. Once an Accommodation Letter is prepared and sent, it will be essential for you to meet individually with the Instructor (via Zoom) to discuss your needs and accommodations and arrange for these to be implemented.
- You also can access the **Counseling and Mental Health Center (CMHC)**, which offers programs and services that enhance and support students’ mental health and well-being. For information on their programs, call (512) 471-3515. If you are experiencing a mental health crisis, call **the CMHC Crisis Line** at (512) 471-2255, 24/7.
- In difficult or emergency situations, you can obtain assistance (not counseling) from **Student Emergency Services**: email [studentemergency@austin.utexas.edu](mailto:studentemergency@austin.utexas.edu) or call (512) 471-5017 (Mon.-Fri., business hours), who will notify your instructors. More information is given at [deanofstudents.utexas.edu/emergency](https://deanofstudents.utexas.edu/emergency). For immediate threats or emergencies, call 911.

## GENERAL UNIVERSITY POLICIES:

- **Academic Integrity:** Each student is 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 is academic dishonesty and entirely unacceptable** and is subject to academic disciplinary action, including failure in the course. You are responsible for understanding UT’s Honor Code which can be found at the following address: <https://deanofstudents.utexas.edu/conduct/standardsofconduct.php>.
- **Sharing of Course Materials is Prohibited:** No materials used in this class including but not limited to Instructor’s Notes, class slides, assignments, quizzes, etc., may be shared online or with anyone outside the class unless you have explicit, written permission of the instructor. Unauthorized sharing of materials promotes academic dishonesty and is a violation of the University’s Honor Code. We are aware that there are sites where unauthorized academic materials are posted, and if any of this course’s materials are found on those sites and are associated with you, this may be reported to the Student Conduct and Academic Integrity in the Office of the Dean of Students, which can result in sanctions or other serious consequences.
- **Q-Drop Policy:** To drop a class after the 12<sup>th</sup> class day you will need to execute a Q drop before the deadline, which is Thurs., Oct. 29 for the Fall 2020 semester. This process is initiated through your student dean, not the course instructor. Under Texas law you are allowed only six Q drops while in college at any public Texas institution. More information is available at <http://www.utexas.edu/ugs/csacc/academic/adddrop/qdrop>.
- **Religious Holidays:** If you will miss a class meeting or be unable to meet a course requirement due to a schedule conflict with observance of a religious holiday, please let the instructor know at least two weeks in advance. You will not be penalized for this although you will still be responsible for material covered in class. Missed credits should be made up in the same way as for any short-term absence, through a later activity or quiz; homework and projects should be turned in ahead of deadlines.
- **Class Recordings:** Class recordings are curated by the Instructor and reserved for private, approved use only by students in the class. They are used strictly for educational purposes and are protected under FERPA. Therefore, recordings will not be shared outside the class in any form. Violation of this restriction could lead to Student Misconduct proceedings.
- **Title IX:** Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, assault, and unprofessional or inappropriate conduct, dating/domestic violence and stalking at federally funded educational institutions. In response, UT can intervene to prevent continuation or escalation, provide support, and investigate and discipline violations. Recent changes on the federal level and Texas law have led to an expanded definition of “mandatory reporters” – personnel who are required to report any potential violation. It is essential that you understand this. Your instructor and T.A. are mandatory reporters under Texas and/or federal law. Consequently, we must report any Title IX-related incidents disclosed to us in writing or verbally. If you might not want to address a situation by making a formal complaint to University authorities, before discussing it with anyone be sure to check whether they are a mandatory reporter (also called a “responsible employee”). If you wish to speak with someone who can provide support without necessarily triggering this consequence, you can email [advocate@austin.utexas.edu](mailto:advocate@austin.utexas.edu). For more information, contact [titleix@austin.utexas.edu](mailto:titleix@austin.utexas.edu), call (512) 471-0419, or visit <http://www/titleix.utexas.edu>. The Title IX office has developed supportive ways to respond to and provide resources for survivors.