

# Astronomy 307: Introductory Astronomy

## Fall 2020

### ***Course Information***

*Unique Course Number:* 46570

*Meeting times:* T/Th 12:30-2:00 pm

*Classroom:* Online via Zoom!

*Course website:* Canvas ([canvas.utexas.edu](https://canvas.utexas.edu))

*Course email:* Please contact Prof. Bowler through Canvas  
(or directly email if urgent or unrelated to this course)

### ***Contact Information***

#### **Instructor**

Prof. Brendan Bowler

Department of Astronomy

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*Online office hours:* TBD

#### **Teaching Assistant**

Sam Factor

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### ***Course Description***

*Astronomy 307* is an introductory overview of the science of astronomy. Topics that will be covered will include the Earth, Moon, and sky; radiation and spectra; the formation, structure, and evolution of stars and planets; the solar system; exoplanets; the structure and evolution of galaxies; cosmology; and the fate of the universe. This course will emphasize critical thinking, scientific literacy, and quantitative approaches to problem solving rather than rote memorization of facts. Course lectures will be supplemented with group activities and peer-to-peer discussions to promote active, inquiry-based learning.

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.

### **Course-Level Learning Objectives:**

After taking this course, you will be able to:

- Develop and assess ballpark estimates for poorly defined astronomical problems through “order of magnitude” calculations.
- Construct physical models of astronomical objects to explain observations and make testable predictions.
- Recount the scientific story of the universe and our place and time within it.

- Use physical principles to describe how planetary systems, stars, and galaxies form and evolve over time.

**Prerequisites:** Mathematics 305G (Preparation for Calculus) or the equivalent, or consent from instructor. Students should feel comfortable with algebra, dimensional analysis, unit conversion, geometry, and topics in pre-calculus, including trigonometry. This course relies on knowledge of these concepts and they will not be reviewed during our lectures. This course is intended primarily for science and engineering majors, but students of all majors are welcome if they prefer a more quantitatively based version of Introductory Astronomy. **AST 307 is intended to be more mathematically rigorous than AST 301, a course which covers the same material but with less emphasis on quantitative applications of astronomical concepts.**

See the “Memo to Undergraduate Astronomy Students Regarding Astronomy Courses” for additional information and expectations for undergraduate courses set by the Department of Astronomy: <http://www.as.utexas.edu/astronomy/education/memo.html>.

### ***Textbooks and Materials***

- **Required:** Access to Pearson’s online *Modified Mastering Astronomy*, either standalone or sold as a bundle with *The Cosmic Perspective* digital e-text (the cheapest option).
- **Required:** *The Cosmic Perspective* (9th, 8th, or 7th Editions), Bennett, Donahue, Schneider & Voit. Students will need either the digital e-text version (optionally sold with *Mastering Astronomy*) or the physical copy, depending on their preference. I will be teaching out of the 9th edition, but the 8th or 7th editions are very similar and are also fine.
- **You will need a scientific calculator for exams.** Please have your calculator ready at each lecture as well.

### ***Online Information and Expectations***

AST307 will be taught online via Zoom in the Fall of 2020. The Zoom link can be accessed via the Canvas course homepage. My goal is to keep the course as similar as possible to the in-person version of AST307. Group activities will be conducted using Breakout Rooms and brief questions will be carried out with real-time polls. **Active, engaged participation from students is extremely important!** This is especially true in an online environment. You are expected to participate in group discussions, work through problems yourself and in groups, and avoid distractions during class.

#### **Expectations for students in an online environment:**

- All classroom norms apply when in a Zoom session. If you wouldn’t do something in a physical class setting, don’t do it in a digital classroom. Please dress in the same attire you would in a university classroom.
- Find a quiet work station with good lighting.
- As for an in-person class, do not browse the internet, email, or social media during class.

- I would prefer for cameras to be turned on during the entire class period so I can see everyone while I teach. If this is problematic for any reason, please contact me so we can find an alternative solution.
- Students should remain muted while the instructor or classmates are speaking.
- During lecture, students must use the Response Icon to raise hands.
- Breakout Room discussions should be structured and on topic. Take turns sharing ideas without any single person dominating the discourse. The instructor, teaching assistant, and learning assistant will be dropping in at random to listen in, promote the discussion, and answer questions.
- Students are welcome to use appropriate digital backgrounds. If no digital Zoom background is used, please be sure there is nothing inappropriate in the background.

**Sharing of Course Materials is Prohibited:** No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. I am well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

**Class Recordings:** Classes may be recorded only by the instructor or TA. Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

### ***Course Requirements***

This course is organized following evidence-based teaching practices that are designed to improve student understanding as well as long-term retention of the material. **Students are required to complete pre-lecture reading and short quizzes following the course schedule listed at the bottom of this syllabus.** Class time will consist of lectures and working through problems both individually and in groups. Assessments will be taken through pre-instruction reading quizzes, during class time, through homework, and tests.

***Pre-Instruction Reading and Quizzes:*** Students are expected to read the assigned chapters in *The Cosmic Perspective* following the schedule listed at the end of this syllabus (which may be subject to slight modification throughout the semester). Selected topics will then be reinforced through lectures and discussions in class. Each reading assignment will be supplemented with a short quiz administered through *Modified Mastering Astronomy*. Students must complete pre-instruction assignments by 12:30pm on the day the assignments are due. The lowest reading

quiz grade will be dropped. Pre-instruction reading quizzes will contribute 10% of the final grade.

**In-Class Participation:** This class will be structured with a combination of shorter lectures as well as interactive lessons and activities. These activities are an important part of the course, therefore attendance and participation is required. The interactive material and discussions are intended to reinforce the concepts in the class and assist you in completing your homework assignments. Participation will make up 20% of your course grade. The three lowest in-class participation scores will be dropped. Students who have excused absences as part of a university-sponsored event are required to notify me in writing a minimum two weeks in advance of the absence.

**Homework:** Homework assignments that will be administered through *Mastering Astronomy*. Each will cover material from about three lectures, on average. The number of questions may vary from one homework to the next, but each assignment will be equally weighted. The lowest homework grade will be dropped.

**Tests:** Four tests will be given. They will be open book. The format will be an in-class and take home hybrid: we will dedicate the class period to take the exam in real time, but you will have 24 hours to complete and submit the exam. Each test will cover material from the textbook, homework assignments, and topics from the lectures. Tests will count for 40% of your course grade. No tests will be dropped. There will be no final exam for this course.

## ***Course Policies***

### *Communication:*

- The course webpage on the Canvas system will be updated with announcements, supplementary resources, and deadlines. It is your responsibility to check Canvas daily. I recommend setting up email alerts so you can be notified when I send messages or post assignments. You may also wish to download the mobile app.
- It is also your responsibility to keep track to the administrative deadlines related to the course, for example add/drop dates and Pass/Fail credit deadlines.
- Email is recognized as an official mode of university correspondence. You are responsible for reading your email for both university and course-related information. Please check your email daily.
- **All questions should be directed through Canvas**, which reaches both myself and the TAs. Please consult this syllabus for answers first!

### *Courtesy and use of electronics:*

- You are expected to arrive to class on time. Out of consideration to me and your fellow students, do not leave class early unless you have talked to me in advance.
- Phone use, social media, and texting during lecture or group activities is not permitted. Please make sure your phones are silenced before class begins.

*Travel:*

- As part of my duties as faculty, I am a professional research astronomer, which may require travel during the semester. I will do my best to minimize the impact of this travel and maintain communication while away. When I am gone, another UT astronomer will lead the class in my place.

*Syllabus Changes:*

- I reserve the right to make changes to the syllabus and class schedule, if necessary. If any changes are made they will be announced through Canvas and new versions will be uploaded.

### ***Absences and Make-Ups***

*Missing Lectures:* In-class activities are a central part of the class, and your attendance and participation is required. However, a few absences will not affect your grade because the 3 lowest attendance/participation scores are dropped.

*Missing Homework:* **Late homework will not be accepted.** If you do not complete an assignment for emergency reasons, contact me by email within three days of the due date of the assignment. In some situations, late assignments may be accepted at my discretion, but documentation will generally be required.

*Missing Tests:* **There are no drop exams, and no makeup 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.

*Religious Observances:* By UT policy, you must notify me of your pending absence at least 14 days prior to the date of observance of a religious holiday. If you must miss a quiz or homework deadline in order to observe a religious holiday, you will be given an opportunity to complete the missed work within a reasonable time.

*Emergencies and University Closings:* If an emergency occurs (for example, a death in the family or hospitalization), you must contact me as soon as possible and provide documentation within one week. In case the University closes on the date of an in-class exam, the exam will take place during the next regularly scheduled class period.

### ***Grading***

This class will not be graded on a curve unless I decide to do so after the course has ended. Final grades will be assigned based on the following breakdown:

*Homework (30% - drop the lowest score)*

*Tests (40% - no drops)*

*Class participation* (20% - three absences allowed)

*Pre-Instruction Reading Quizzes* (10% - drop the lowest score)

$87.00\% \leq B+ < 90.00\%$	$93.00\% \leq A \leq 100\%$	$90.00\% \leq A- < 93.00\%$
$77.00\% \leq C+ < 80.00\%$	$83.00\% \leq B < 87.00\%$	$80.00\% \leq B- < 83.00\%$
$67.00\% \leq D+ < 70.00\%$	$73.00\% \leq C < 77.00\%$	$70.00\% \leq C- < 73.00\%$
	$63.00\% \leq D < 67.00\%$	$60.00\% \leq D- < 63.00\%$
	$F < 60\%$	

Note that no exceptions will be granted to this grading structure. There will be no rounding and there will be no extra credit in this course. Emails to me at the end of the semester asking about either will be referred to this syllabus.

**Would you like to know your approximate grade at any particular point in the course?** You can estimate it yourself using the following equation:

$$G_{\text{current}} = 0.3 \times \frac{\sum_{i=1}^{N_{\text{HW}}-1} G_{\text{HW},i}}{N_{\text{HW}} - 1} + 0.4 \times \frac{\sum_{i=1}^{N_{\text{Test}}} G_{\text{Test},i}}{N_{\text{Test}}} + 0.2 \times \frac{N_{\text{Part}}}{N_{\text{Classes}} - 3} + 0.1 \times \frac{\sum_{i=1}^{N_{\text{RQ}}-1} G_{\text{RQ},i}}{N_{\text{RQ}} - 1}$$

Here  $G_{\text{Current}}$  is your current grade,  $G_{\text{HW},i}$  is your grade for homework  $i$ ,  $N_{\text{HW}}$  is the current number of homeworks that have been past due,  $G_{\text{Test},i}$  is your grade for test  $i$ ,  $N_{\text{Test}}$  is the number of tests that have been taken to date,  $N_{\text{Part}}$  is the total number of classes you've participated in (after removing the three lowest scores),  $N_{\text{Classes}}$  is the total number of classes held to date,  $G_{\text{RQ},i}$  is your grade for the pre-instruction reading quiz  $i$ , and  $N_{\text{RQ}}$  is the number of pre-instruction reading quizzes administered to date. One homework and one pre-instruction reading quiz will be dropped, which accounts for the  $N-1$  in those terms. Excused absences will be taken into account in the participation component. Each term is weighted by its proportional contribution to your final grade. As a reminder, here is an example of summation notation:  $\sum_{i=1}^3 i = 1 + 2 + 3 = 6$

For example, if you received grades of 79%, 90%, 88%, 95%, and 100% on five homeworks; grades of 88% and 92% on two tests; grades of 99%, 90%, 80%, 70%, and 0% on reading quizzes; and attended and participated in all classes, you would currently have a 92.45% (A-) in the class.

### ***Academic Dishonesty***

*The University of Texas Honor Code:* The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Standards for Academic Integrity are posted at <http://deanofstudents.utexas.edu/conduct/index.php>

*Plagiarism:* The University of Texas at Austin takes plagiarism very seriously. Do not risk getting involved in a plagiarism infraction; the consequences simply aren't worth it. Always cite your sources, and when in doubt consult a professor or librarian. You may read more about plagiarism at the Student Judicial Services website: <http://deanofstudents.utexas.edu/conduct/academicintegrity.php>

The minimum penalty for cheating is receiving a zero on the assignment on which you cheated. I reserve the right to seek a penalty I deem 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 (for example, looking at someone else's answer, utilizing "cheat sheets" of any form or fashion either paper or digitized, or getting an advance copy of an assessment), I also consider allowing someone else to use your Modified Mastering Astronomy account cheating. If the academic dishonesty is sufficiently serious, I will proceed by filing a formal report to the Judicial Services in the Dean of Students Office, following university policy. Judicial Services would then 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).

### ***Students with Disabilities***

Please notify me of any modification/adaptation you may require to accommodate a disability-related need. The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact Services for Students with Disabilities (SSD) at (512) 0471-6259 (voice) or (512) 232-2937 (video phone) or <http://diversity.utexas.edu/disability/>. If you request academic accommodation for a disability, please provide appropriate documentation from the SSD Office at the beginning of the semester.

### ***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.

### ***Harassment and Assault***

Harassment of any sort will not be tolerated in this classroom or related workspaces. 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 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).

### ***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.

### ***Students with Children***

I recognize the difficulty of being a full time student with children. If you have children, or other family commitments, please come see me to discuss any modifications of the course policies which will maximize your success in this course.

## ***Course Schedule\****

All assignments must be turned in by the time listed on the Modified Mastering Astronomy course site.

<b>Week</b>	<b>Dates</b>	<b>Topics</b>	<b>Cosmic Perspective Chapters**</b>	<b>Reading Quizzes and Homework***</b>	<b>In-Class Exams</b>
<b>Week 1</b>	Aug 27	Course overview			
<b>Week 2</b>	Sep 1, 3	A Brief Tour of the Universe; the Speed of Light	Read Ch. 1 Review Appendix C		
<b>Week 3</b>	Sep 8, 10	The Night Sky; Coordinates	Read Ch. 2.1, S1.2, Mathematical Insight 15.3	RQ #1	
<b>Week 4</b>	Sep 15, 17	Seasons; The Moon and Eclipses	Read Ch. 2.2-2.4	RQ #2 HW #1	
<b>Week 5</b>	Sep 22, 24	Planetary Motion; Kepler's Laws; Gravity	Read Ch. 3 and 4	RQ #3 HW #2	<b>Sep 24: Exam #1</b>
<b>Week 6</b>	Sep 29, Oct 1	Radiation; Matter	Read Ch. 5	RQ #4	
<b>Week 7</b>	Oct 6, 8	Spectra; Telescopes	Read Ch. 6	RQ #5 HW #3	
<b>Week 8</b>	Oct 13, 15	The Sun; Fusion	Read Ch. 14	RQ #6 HW #4	<b>Oct 15: Exam #2</b>
<b>Week 9</b>	Oct 20, 22	Properties of Stars	Read Ch. 15	RQ #7 HW #5	
<b>Week 10</b>	Oct 27, 29	Stellar Birth, Evolution, and Death	Read Ch. 16, 17, and 18	RQ #8, #9 HW #6	
<b>Week 11</b>	Nov 3, 5	The Solar System	Read Ch. 7 and 12	RQ #10	<b>Nov 5: Exam #3</b>
<b>Week 12</b>	Nov 10, 12	Binary Stars; Exoplanets	Read Ch. 13	RQ #11 HW #7	
<b>Week 13</b>	Nov 17, 19	Galaxies and Dark Matter	Read Ch. 20.1, 23.1, and 23.2	RQ #12 HW #8	
<b>Week 14</b>	Nov 24	The Expanding Universe	Read Ch 20.2 and 20.3	RQ #13	
<b>Week 15</b>	Dec 1, 3	The Accelerating Universe; Dark Energy; Cosmology	Read Ch. 22, 23.3, and 23.4		<b>Dec 3: Exam #4</b>

\* Subject to minor changes

\*\* Cosmic Perspective, 9th Edition

\*\*\* See Modified Mastering Astronomy page for RQ and HW due dates. Subject to change.