

# Astronomy 301: Introduction to Astronomy (Spring 2023)

Unique Number 47855

In person, Tuesday/Thursday 9:30am-11:00am (Welch 3.502)

Instructor: Prof. [Mike Boylan-Kolchin](#) (he/him)

## Course Overview and Objectives

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This course provides an overview of astronomy, including basic physical concepts, planets, stars, galaxies, and cosmology. It will cover the familiar (e.g., the solar system, the Sun) and the exotic (e.g., black holes, dark matter, dark energy). The course will focus on conceptual understanding rather than memorization of facts. You will learn how science works, develop critical thinking skills, and gain an appreciation for the Universe around us and of the importance of continued scientific study (both applied and theoretical). The concepts will be primarily qualitative, though you will be expected to be able to do basic mathematics (exponents, ratios, unit conversions, etc.).

In this course, you will:

- develop physical intuition the Universe, its contents, and its evolution over cosmic time
- discover how Astronomy has developed over millennia and connections to current trends
- understand the seasons, the phases of the moon, and the contents of the solar system
- learn about how stars are born, evolve, and die
- understand our current understanding of extrasolar planets
- learn about dark matter, dark energy, and black holes
- discover the frontiers of astrophysical research

*There are no prerequisites for this course.* AST 301 is intended to meet the requirements for the Core Component Area Natural Science and Technology and may be combined with AST 309G, 309L, 309N, 309R, or 309S for a six-hour Core sequence. This course will include work designed to develop skills in critical thinking, communication, quantitative analysis, and teamwork. Communication in the course will include student questions and subsequent classroom discussions during lecture. Teamwork in the course may consist of working in small groups during help sessions and instructor-modeled problem solving that is guided by student decisions and group feedback.

**Course Modality:** This course is in-person only. *There will be no alternative to in-person attendance, other than normal emergency accommodations.*

## Course Flags

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**This course carries a Quantitative Reasoning (QR) 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.

## How Will I Succeed in this Course?

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I have confidence that every single person in this course can learn the material and earn a good grade, provided you engage with the material. I believe that the two most important components of success in this class are:

- **Keep an open mind and try hard:** while much of the material can seem complicated, we will try to focus on intuition and concepts.
- **Don't fool yourself:** R. Feynman famously said "The first principle is that you must not fool yourself, and you are the easiest person to fool." It is easy to convince yourself that you understand something; it's important to be sure that you really do understand it. *it's OK to be confused about a topic, an equation, or a concept!* And it's definitely OK to ask questions, even if you're afraid they might be too simple/ And the reverse is true: don't be overly pessimistic about yourself and your abilities. I know you can fully grasp the material and do well in the course!

### Course Website and Email

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The course website will be hosted on [Canvas](#). **Make sure that you are able to access and receive emails through Canvas.** Email is recognized as an official mode of university correspondence; you are responsible for reading your email for university and course-related information & announcements. **I will post PDFs of each day's slides from class to canvas after class.**

### Course Textbook (required)

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*The Cosmic Perspective* (9th Edition), Bennett, Donahue, Schneider & Voit  
*Mastering Astronomy* (connect through Canvas).

The materials for this class are available through the Longhorn Textbook Access (LTA) program, a collaboration between UT Austin, The University Co-op and textbook publishers to significantly reduce the cost of digital course materials for students. You can access your required materials through the My Textbooks tab in Canvas. You are automatically opted into the program but can easily opt-out (and back in) via Canvas through the 12th class day. If you remain opted-in at the end of the add/drop period (12th class day fall/spring, 4th class day summer sessions), you will receive a bill through your [What I Owe](#) page. If you do not pay your bill by the specified deadline, you will lose access to the course materials and your charge will be removed. More information about the LTA program is available at <http://universitycoop.com/longhorn-textbook-access>.

**I strongly urge you to use the LTA option for this course** *Mastering Astronomy* is required, as it will be used for homework assignments and related aspects of the course. I cannot guarantee that you will be able to access *Mastering Astronomy* if you do not use the LTA option.

### Course Expectations

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- **Attendance and Engagement:** Course attendance is crucial for understanding the complex material we will be covering. Additionally, we will be doing regular group exercises in class. These exercises are important for building your understanding and intuition about difficult problems. I always welcome questions about the course material during class or office hours.

Absences for illness, religious observances, participation in University activities at the request of University authorities, and compelling circumstances beyond the student's control are excused under University policy. Please inform the instructor *in advance* of any absences or schedule conflicts for religious observances.

- **Preparation:** This course covers fascinating but sometimes conceptually challenging subjects. I will make every effort to help you understand these topics with a minimum of mathemat-

ics. However, a working understanding of high school algebra is required, and mathematical reasoning is part of the class.

- **Assignments:** It is fine to discuss concepts with your classmates – trying to explain something to someone else is a good way to see how well you understand it! We will also engage in frequent group discussions in class. **However, it is crucial to remember that all graded assignments, including homeworks and quizzes, must consist of your own thoughts in your own words.** Please also see the statement on academic integrity below.

## Grading

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You will receive the grade you earn in this course. **There will be no extra credit awarded during or after the semester**, so please be sure to put in the effort during the semester to earn the grade you want. Your grade will be based on the following components components:

- *Homework:* 40%.

Homework will generally be due once every two weeks (for a total of 7 assignments), on Friday at 5pm. After that time, it will be considered late. Late homework will receive a penalty of either 10% (if it is received by 5pm on the Tuesday following the due date) or 25% (if it is received by 5pm the Friday following the due date). Homework will not be accepted later than 1 week after the due date. **Your (one) lowest homework grade will be dropped.**

If you have a valid emergency that prevents you from making a homework deadline, you should make all reasonable efforts to contact me before the due date telling me the nature of the emergency. Please document all such emergencies; a self-signed note is sufficient provided that it contains a statement that (1) the information is true and correct and (2) you are aware that providing false information is prohibited under the Code of Student Conduct. If, for any reason, the University is officially closed on the day of the due date, the due date will be moved to the next lecture.

- *In-class Quizzes:* 40%

There will be 6 total in-class quizzes every other Thursday (on weeks when HW is not due). These will take ~ 20 minutes and are designed to reinforce important concepts in the class. There is substantial research that frequent, small-stakes evaluations are highly beneficial in long-term understanding of a subject (see *Make it Stick: The Science of Successful Learning* by P. Brown et al. for more details). **Your (one) lowest quiz grade will be dropped.** If you must be absent for an extended period or miss more than one quiz, please arrange to discuss this with me.

- *Participation:* 20%

We will make frequent use of instapoll for in-class questions to gauge how people are absorbing the material in real time. *Your grade will **not** be based on whether you are correct in your answers;* the point is to try, so your participation via instapoll will receive full credit. **Your four lowest participation grades will be dropped.**

**There will be no comprehensive final exam.**

Your grade will be computed as follows: the average grade you receive in each of the components listed above will be weighted by the percentage listed above and then rounded to the nearest 1

decimal place. Your final grade will be given by the following scale:

93 – 100: A

90 – 92.9: A-

87 – 89.9: B+

83 – 86.9: B

80 – 82.9: B-

77 – 79.9: C+

73 – 76.9: C

70 – 72.9: C-

67 – 69.9: D+

63 – 66.9: D

60 – 62.9: D-

< 60: F

### **Class Policies**

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- *Respect for others is vital.* I am: invested in the educational experience of each student in the class, respectful of individual differences, encouraging of creativity, available to discuss material and assignments; thorough in evaluating assignments; and rigorous yet supportive in maintaining high standards for performance. As a student, you are expected to work individually and with others, to create an atmosphere that is safe, valuing of one another, and open to diverse perspectives. Everyone is expected to show courtesy, civility, and respect for one another. Comments or postings that degrade or ridicule another, whether based on individual or cultural differences, are unacceptable.
- My official responsibilities as a professor occasionally require me to participate in external events. I will do my best to ensure these events do not conflict with class time; if I do have to miss any instructional time, another PhD UT astronomer will lead the class.
- **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:** Any 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.

- **Religious Holidays:** According to UT Austin policy, you must notify the professor of a pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

## **COVID-19 Update**

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COVID-19 continues to circulate and can lead to serious (and sometime chronic) illness. Stay up-to-date on [COVID-19 vaccinations](#) by getting all available boosters when eligible. Vaccines are available through University Health Services. Masks, when properly worn, reduce the spread of COVID-19. Disposable masks are available for students at the William C. Powers, Jr. Student Activity Center and the Texas Union hospitality desks. For any illness, students should stay home if they are sick or contagious, not only to stop the spread, but also to prioritize their personal well-being. UHS provides [symptomatic COVID-19 testing](#) for students. Schedule your appointment by calling 512-471-4955 or online within the [MyUHS patient portal](#). Learn more about [symptomatic COVID-19 testing here](#). I encourage everyone to proactively test for COVID-19 throughout the semester as well.

## **Personal Pronouns**

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Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the students legal name, unless they have added a “preferred name” with the Gender and Sexuality Center (<http://diversity.utexas.edu/genderandsexuality/publications-and-resources/>). I will gladly honor your request to address you by a name that is different from what appears on the official roster, and by the gender pronouns you use. Please advise me of any changes early in the semester so that I may make appropriate updates to my records. For instructions on how to add your pronouns to Canvas, visit <https://utexas.instructure.com/courses/633028/pages/profile-pronouns>.

## **University Deadlines**

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Please see <http://registrar.utexas.edu/calendars/22-23> for relevant University deadlines (including drop deadlines)

## **Academic Integrity Expectations**

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**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 academic misconduct are subject to the student conduct process and potential disciplinary action. A student found responsible for academic misconduct may be assigned both a status sanction and a grade impact for the course. The grade impact could range from a zero on the assignment in question up to a failing grade in the course. A status sanction can range from probation, deferred suspension and/or dismissal from the University. To learn more about academic integrity standards, tips for avoiding a potential academic misconduct violation, and the overall conduct process, please visit the Student Conduct and Academic

Integrity website at <http://deanofstudents.utexas.edu/conduct>

**Plagiarism:** As a research university, The University of Texas at Austin takes plagiarism very seriously. Do not risk getting involved in a plagiarism infraction – the consequences simply are not worth it. Always cite your sources, and when in doubt, consult a professor or librarian.

### **Accessible, Inclusive, and Compliant Statement**

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The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations, please contact [Disabilities and Access \(D&A\)](#). If you are already registered with D&A, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.

### **Behavior Concerns Advice Line (BCAL)**

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If you have concerns about the safety or behavior of fellow students, TAs or professors, contact [BCCAL](#) (the Behavior Concerns and COVID-19 Advice Line) or by calling at 512-232-5050. Confidentiality will be maintained as much as possible, however the university may be required to release some information to appropriate parties.

### **Title IX Reporting**

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Title IX is a federal law that protects against sex and gender based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence and stalking at federally funded educational institutions. UT Austin is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can: (1) Intervene to prevent harmful behavior from continuing or escalating; (2) Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation; (3) Investigate and discipline violations of the university's relevant policies.

Beginning January 1, 2022, Texas Education Code, Section 51.252 (formerly known as Senate Bill 212) requires all employees of Texas universities, including faculty, report any information to the [Title IX Office](#) regarding sexual harassment, sexual assault, dating violence, and stalking that is disclosed to them. Texas law requires that all employees who witness or receive any information of this type (including, but not limited to, written forms, applications, one-on-one conversations, class assignments, class discussions, or third-party reports) must report it to the Title IX Coordinator. Before talking with me, or with any faculty or staff member about a Title IX related incident, please remember that I will be required to report this information.

Although graduate teaching and research assistants are not subject to Texas Education Code, Section 51.252, they are [mandatory reporters](#) under federal Title IX regulations and are required to report [a wide range of behaviors we refer to as sexual misconduct](#), including the types of misconduct covered under Texas Education Code, Section 51.252. Title IX of the Education Amendments of 1972 is a federal civil rights law that prohibits discrimination on the basis of sex including pregnancy and parental status in educational programs and activities. The Title IX Office has

developed supportive ways and compiled campus resources to support all impacted by a Title IX matter.

If you would like to speak with a Case Manager for Support and Resources, who can provide support, resources, or academic accommodations, in the Title IX Office, please email: [supportandresources@austin.utexas.edu](mailto:supportandresources@austin.utexas.edu). A Case Manager can also provide support, resources, and accommodations for pregnant, nursing, and parenting students. For more information about reporting options and resources, please visit: <http://titleix@austin.utexas.edu>, contact the Title IX Office via email at: [titleix@austin.utexas.edu](mailto:titleix@austin.utexas.edu), or call 512-471-0419.

### Preliminary Course Outline

Note: changes to this schedule may be made at my discretion and if circumstances require. It is your responsibility to note these changes when announced (although I will do my best to ensure that you receive the changes with as much advanced notice as possible).

Dates	Topics
Jan 10, 12	Course overview; units and scales; a brief tour of the Universe
Jan 17, 19	The night sky; the seasons; the Moon; eclipses; <i>HW 1</i>
Jan 24, 26	The history of astronomy and the scientific method; <i>quiz 1</i>
Jan 31, Feb 2	Modern astronomy's beginnings; Kepler and Galileo; <i>HW 2</i>
Feb 7, 9	Newton, and Gravity; <i>quiz 2</i>
Feb 14, 16	Relativity; the nature of light; atoms; <i>HW 3</i>
Feb 21, 23	Atomic spectra; properties of stars; <i>quiz 3</i>
Feb 28, Mar 2	Fusion and the Sun; stellar evolution; <i>HW 4</i>
Mar 7, 9	Stellar deaths; black holes; <i>quiz 4</i> <i>March 14, 16: Spring Break</i>
Mar 21, 23	The solar system; extra-solar planets; <i>HW 5</i>
Mar 28, 30	Planets; life in the Universe; <i>quiz 5</i>
Apr 4, 6	Galaxies and the large-scale structure of the Universe; <i>HW 6</i>
Apr 11, 13	Dark matter and dark energy; <i>quiz 6</i>
Apr 18, 20	The Big Bang; open questions in Astronomy <i>HW 7</i>