

ASTR 0001: A Survey of the Universe

Fall 2025 | Sec 02

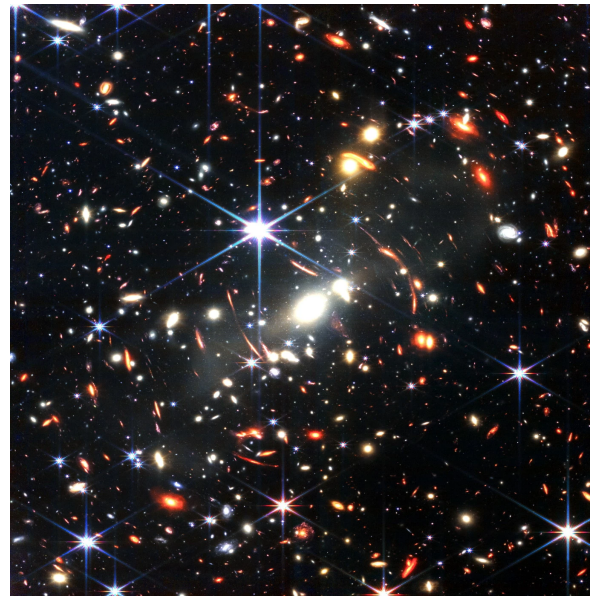
with [Prof. Mathew Madhavacheril](#)

Tuesdays and Thursdays 10:15am-11:44am

Lecture hall **TBD** in David Rittenhouse Laboratory (DRL; 33rd and Walnut St.)

Office hours: Tue and Thu 3-4pm, DRL 4N39

[How to get to my office](#)



***Image:** A small region of the sky observed by the James Webb Space Telescope in mid-2022. Most of the objects are distant galaxies each containing hundreds of billions of stars.*

IMPORTANT: Engineering students receive no credit for this course.

SYLLABUS

This course is an introduction to astronomy for non-majors. We will survey theories and observations of the astronomical universe, from our own solar system, to stars, galaxies and the study of cosmology, i.e. the birth and evolution of the Universe as a whole.

The Earth is big, the Solar System is a lot bigger, the galaxy is immensely bigger, and even just the *observable* universe is unfathomably bigger. We will build perspective for the vastness of the cosmos. We will develop quantitative skills towards describing and understanding the processes in it, starting near home: understanding seasons and the phases and eclipses of the moon, all the way to describing mysterious components of the Universe like Dark Matter and Dark Energy.

Importantly, a broad goal of this course is for you to be able to go beyond just facts and stories, but push to a deeper understanding of the scientific underpinnings of astronomy. We will often ask “**how do we know what we know?**”, and we will often remind ourselves how the scientific framework around modern astronomy allows us to not just make predictions but also allows us to *falsify* our theories. Yet another theme we explore is how simple fundamental physics notions allow us to have elegant descriptions of the various processes in the Universe.

Prerequisites and credits: Elementary algebra and geometry will be used. This course is not recommended for physical-science majors or engineering students. Engineering students receive no credit for this course. This course fulfills the quantitative data analysis requirement.

Attendance: We will have lectures in-person. **5% of the course grade will be based on questions during class time.** In-person attendance is critical if you hope to perform well in this course: while a little more than half of each class will involve a lecture, the remaining in-class time will be dedicated to interactive sessions, demonstrations as well as problem solving walk-throughs. **There will also be graded lab sessions where you will perform astronomical measurements from the DRL rooftop observatory.**

Accommodations

It's important to me that everyone who wants to participate has the [resources](#) to be fully included in this course. Please let me know if you need special accommodations in the curriculum, instruction or assessments of this course to enable you to participate fully. I will make every effort to maintain the confidentiality of the information you share with me.

Penn provides reasonable accommodations to students with disabilities who have self-identified and been approved by [Student Disabilities Services](#) (SDS). If you have not yet contacted SDS and would like to request accommodations or have questions, you can make an appointment by calling SDS at 215-573-9235. The office is located in the [Weingarten Learning Resources Center](#) at Stouffer Commons: 3702 Spruce Street, Suite 300. All services are confidential.

Topics

- A New Perspective through Astronomy
- The Universe You See and Experience
- Astronomy as a Science
- Motion, Energy and Gravity
- Light and Matter
- Extending Human Capability with Telescopes
- Our Solar System and its Formation
- Planetary Geology and Atmospheres
- Jovian Planets
- Asteroids, Comets and Dwarf Planets
- Exoplanets
- The Sun
- Surveying the Stars
- Star Birth
- The Life Cycle of a Star

- Stellar Graveyards and Black Holes
- Our Galaxy
- The Extra-Galactic Universe
- Galaxy Evolution
- The Big Bang
- The Dark Universe
- Life in the Universe

Materials

- **Required: Mastering Astronomy** web access. See the end of this Syllabus for instructions on how to enroll. (Once you have paid or requested temporary access, click on "Access Pearson" on the left panel on Canvas to finish setting it up.)
[See here for more information.](#)
- The above material includes access to the eText for the textbook for this course:
Cosmic Perspective, 10th Ed, Bennett, Donahue, Schneider, Voit
ISBN 13: 8220144759998
Readings will be assigned from it; you are expected to come to class having read the assigned material. In-class questions will be based on the readings.
- Slides will be made available on Canvas, either after class or right before.

Frequently Asked Questions

- **Class is about to start, but I don't see the lecture slides posted. What gives?**
Just remind me! I can quickly link them right as class starts.
- **Are grades curved?**
Individual components like exams and homework assignments are not curved, but the final grade that includes all components may be curved together with other sections.
- **I can't find any open slots for observing slots! What should I do?**
All communication regarding the observing lab has to go to Simon Dicker; he will guarantee you an observing slot.
- **Can I use AI tools in this class?**
Generally, no. See below for AI policy.
- **Are aliens real?**
We will discuss this at the last lecture.

Evaluation

There will be **in-class questions**, **1 homework assignment** roughly every week, **an astronomy lab**, **two mid-terms** and **a final**:

1. Mid-Term 1 will be on TBD (drop deadline is TBD)
2. Mid-Term 2 will be on TBD (withdraw deadline on TBD)
3. Final examination date TBD
4. The astronomy lab can be scheduled throughout the semester through Canvas with our lab instructor Simon Dicker

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|---|------------------|
| • In-class questions | 5% of the grade |
| • Homeworks will count toward | 30% of the grade |
| • Your mid-terms will count to | 30% of the grade |
| • The astronomical observation lab will count towards | 10% of the grade |
| • The final will count to | 25% of the grade |

Homeworks will be administered online and instantly graded through [Mastering Astronomy](#), which is a required material for this course.

Each mid-term is scheduled a few days before the Drop and Withdraw deadlines, respectively. Grades should be available well before those deadlines.

In-class questions: During lectures, you will occasionally need to answer a few questions related to the material using your laptops or phones. These are worth a total of 5% of the final grade (**90% participation and 10% correctness**). To participate, you should directly login to <https://learningcatalytics.com/> using the same Student ID and password you use for Mastering Astronomy. **Note that participating in the in-class questions while not physically in class will be considered as a breach of academic integrity. This will cause you to forgo the full 5% of this grade component, and you may also be reported to the University.**

Extensions and deadlines: Homework assignments have strict deadlines. Requests for extensions typically require a medical or other serious reason, but **one** (and no more) extension during the semester may be provided at the discretion of the instructor without requiring a medical reason. Grades for in-class lecture questions may be excused on **two** (and no more) occasions at the discretion of the instructor without requiring a medical reason. Exams cannot be made up without a medical or other serious reason, and require discussion with your advisor.

AI Policy

Use of Artificial Intelligence (AI) tools is generally discouraged for this class, and use of language models (e.g. ChatGPT) for written portions of this class can constitute academic dishonesty. Some AI tools may be bundled with your eText, and Google search results may show “AI Overview”. Output generated by these should generally be ignored since it often contains inaccuracies and hallucinations.

You are required to solve homework problems and questions on your own, without the assistance of language models. Similarly, all written work submitted (including observation lab reports) must be your own work and not use LLM-generated outputs. While it is currently not possible to conclusively prove that text was generated by a language model, future technology

may be able to detect AI-forged work; this should be kept in mind when submitting assignments. Usage of AI or LLM for solving homework problems and submitting reports is considered a violation of Penn's Code of Academic Integrity, and suspected use will be referred to the Center for Community Standards & Accountability (CSA).

Tips for performing well

- **Come to class.** The textbook covers a lot of material. What I cover in class is what will be tested in the exams. Lectures will not be recorded or broadcast.
- **Submit all your work;** don't miss a homework assignment. Students near grade boundaries may be bumped up at the end of the semester, but only if they submitted all homework assignments, lab material and attended **all three** exams.

Communication

Join the Discord server. ([Link on Canvas](#)) This server can be used primarily for text and voice communication with your classmates. I may be available on it as well, but it could take a day or more for you to get a response.

- **From me to you:** check for announcements on Canvas and/or email at least once between classes. I will also make announcements at the start of class.
- **From you to me:** [use the Canvas Inbox to contact me](#). Don't count on my replying quickly to messages: expect a response **within 2 business days** (i.e. not on weekends).
- **From you to you:** you will also be able to answer each other's questions using Discord. I expect you to follow the guidelines provided in the syllabus to keep our online discourse inclusive of and useful for everyone.
- **Office hours:** Tuesdays and Thursdays 3-4pm, DRL 4N39. See [how to get to my office](#).

COVID Precautions

In order to keep everyone as safe as we can, please respect the following [precautions](#):

- **Get vaccinated.** This is required by Penn for all students, faculty, and staff, with few exceptions.
- **If you feel sick or were exposed to COVID, get a test if possible**
- **If you test positive for COVID, please do not come to class or office hours.** Specifically, please participate remotely for 5 days after a positive COVID test. Let me know you'll miss class by filing a [Course Absence Notice](#), keep up with the material online, and follow up with me to make up assignments as needed. **Your grade in this class will not be penalized for precautions to protect each other from COVID.**

- **You can rest assured that I will follow similar precautions if I feel sick or were exposed to COVID or test positive for COVID. It is likely that the class will be held remotely on Zoom if this happens.**
- **You are invited to wear a mask in class if you:**
 - want to for any reason
 - are immunocompromised and personally at high risk
 - are in frequent close contact with someone who is high risk
 - tested positive for COVID-19 more than 5 but less than 10 days ago (if less than 5 days, please participate remotely)
 - have been exposed to someone with COVID-19
 - have recently traveled to an area with substantial or high spread of the virus

Please respect the choices of your classmates. If you feel targeted or uncomfortable in class, speak with me.

Academic Integrity

Participants are expected to abide by the [Penn Code of Academic Integrity](#) in letter *and* spirit. Scientific research is a collaborative endeavor that depends on proper acknowledgment of each person's contributions to a project: this holds in this course as it does in general.

Cheating and violations of academic integrity may be reported by the instructor for further disciplinary action. The following in particular should be noted: you may discuss homework questions with others in broad, general terms, but the work you submit should be your own. Giving homework answers to another person or taking them from another person counts as cheating. The homework is meant as practice for the exams, so if you take answers from others, you are not only violating the code of academic integrity, but also making it likely that you will perform poorly in the exams. This doesn't mean you can't work together; you could, for example, solve the problems together at a blackboard, and then go back and re-do the homework individually without copying from the blackboard.

"Creating a supportive environment to enable scientific discourse
... is the responsibility of all participants."

American Physical Society,
Code of Conduct for APS Meetings

Fostering an inclusive atmosphere in scientific discussions is an integral part of academic and professional ethics. Participants are expected to abide by the [Penn Code of Student Conduct](#) during course activities, and to use the following guidelines as a standard of behavior¹:

Expected Behavior

- Be considerate, respectful, and collaborative.

¹ Adapted from the [Ecological Society of America meeting code of conduct](#).

- Critique ideas rather than individuals.
- Avoid personal attacks directed toward other participants.
- Be mindful of your surroundings and of your fellow participants.
- Congratulations on reading this far into the syllabus. Send me an email during the first week of classes with the code PaleBlueDot and I will provide an additional 1% extra credit. This is only available during Week 1 of the course.
- Respect the rules and policies of our online classroom in [Canvas](#), Discord, and [Zoom](#).

Unacceptable Behavior

- Harassment, intimidation or discrimination in any form will not be tolerated.
- Physical, verbal, or online abuse of any participant will not be tolerated.
- Examples of unacceptable behavior include, but are not limited to: verbal or online comments related to gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, religion, national origin, as well as inappropriate use of nudity and/or sexual images, and threatening or stalking any participant.
- Recording or photographing another individual without their explicit permission is not allowed.

Consequences

- Anyone requested to stop unacceptable behavior is expected to comply immediately.
- The course instructor may take any action deemed necessary and appropriate, including immediate removal from a class session or the course, or referral to university disciplinary procedures.

Reporting Unacceptable Behavior

- If you are the subject of unacceptable behavior or have witnessed any such behavior, please immediately notify the instructor.
- Anyone experiencing or witnessing behavior that constitutes an immediate or serious threat to public safety should contact campus security at **215.573.3333**.

Any member of the Penn community can call the Penn HELP line² at any time to be connected with staff trained for mental health referrals:

215-898-HELP(4357)

² <https://www.publicsafety.upenn.edu/safety-initiatives/help-line-215-898-help/>