

Outlier

Introduction to Astronomy ***ASTRON 0085*** ***3 Credits***

Instructors

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Course Description

This course is a tour of the history of the universe using modern technology and the constantly evolving knowledge of generations of astronomers and physicists. This course uses relevant and exciting discoveries to introduce light, the origin of the solar system, the Sun, the Earth, the Moon, the inner and outer planets and their moons, exoplanets, the life cycles of stars, dead stars, the Milky Way and other galaxies, black holes, the Big Bang, dark matter and energy, and the fate of the universe.

Course Learning Outcomes

- Explain how the methods of science are used to make astronomical discoveries
- Compare and contrast the relative sizes of planets, stars, galaxies, and the observable universe
- Relate the motions of the earth, moon, and sun to seasons, moon phases, eclipses, and the apparent motion of the stars
- Explain the properties of light
- Describe the properties of telescopes used to observe the sky
- Describe the structure and composition of planets and planetary systems
- Characterize the gravitational interplay of the Sun and the planets in our solar system
- Identify the physical properties of stars
- Understand the energy dynamics of solar activity
- Describe the techniques used to study distant stars and how they were first used to measure the distance to our Sun
- Describe the life cycle of stars and black holes
- Describe the structural components of the galaxy
- Describe the formation and evolution of galaxies

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- Relate the existence of dark matter to the expansion of the universe
- Describe theories of the end and beginning of the universe

Course Materials

This is an online course. All course materials (including lecture videos, interactive textbook, and practice exercises) are provided by Outlier.org through its course website, astronomy.outlier.org. Additional tools will be made incorporated into or linked from Outlier.org.

Math Requirements

Some of the course material involves mathematical calculations. Students will be expected to be able to apply, solve, and evaluate algebraic equations. Students will also be expected to have an understanding of scientific notation and to be proficient at using a calculator.

Class Policies

1. **Attendance & Attention to Course Materials** – As an online course, attendance is asynchronous and is tracked by students viewing the required lectures, engaging with interactive online materials, and completing problem sets. Each student will have the option to spend as much time as needed learning and practicing with additional materials and practice questions. The level of their understanding will be demonstrated by their performance on a set of mastery assessments in the form of quizzes, midterm exams, and a final exam.
2. **Access to Online Course Platform:** All course materials will be accessed through the course website astronomy.outlier.org. Course progress will be tracked and saved once the student logs in. The Course Homepage allows students to view graded assignments and course progress.
3. **Assessment Completion & Late Work** – This course's assessments include quizzes, midterm exams, and a final exam. The exams must be completed by their due dates within their scheduled windows (as indicated on Outlier.org). These assessments are eligible to receive a 24-hour extension of the scheduled due date. Extensions can be requested by submitting a short request form directly on the Outlier.org site, available within 24 hours of the assessment deadline. Without an approved extension, late work will not be accepted. Failure to complete an assessment by the indicated due date will result in a grade of 0 for that assessment.
4. **Calculators** – Students are allowed to use calculators for all assignments. We suggest Desmos, available on both desktop and as an app for Android and iOS.
5. **Exams** – In order to maintain high standards of academic integrity we use online technology to proctor exams. Students will be asked to confirm their identity with a photo ID and students will be required to grant access to their computer, including its webcam, screen, and microphone, for

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the duration of the exam. Each exam can be taken anytime during the exam open period but must be completed in a single contiguous sitting. Times and dates below are all based on Eastern Standard Time. Exams will be available from the open date at 12:00pm ET through the closing date at 12:00pm ET.

6. **Quiz and Exam Materials** – Students are allowed to use a scientific calculator on quizzes and exams. Smartphones cannot be used during exams; if using Desmos, it must be used in a separate tab in the same browser window that the student is using to complete the assessment. They may not use any other kind of notes, websites, books, or any other type of aid on course quizzes and exams.
7. **Academic Integrity** – Students in this course will be expected to agree to and comply with the [Outlier.org Academic Integrity Policy](#). Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process as outlined in the [Outlier.org Academic Integrity Policy](#). Graded assessments such as quizzes or exams are to be completed independently and should contain students' own work. Unless explicitly called for or allowed by an assignment or assessment, using AI content generators is considered plagiarism.
8. **Student to Instructor Communications** – Most learning will happen within the Outlier course. Students can use the button in the bottom right corner to submit feedback or ask questions about any of the content in the lectures, active learning, or problem sets. Students can also reach a Success Advisor by sending an email to success@outlier.org or by engaging in the course Discussion Community.
9. **Course Participation** – Students will join Outlier's Discussion Community and participate in weekly conversations with the course facilitators and their peers to earn the discussion group portion of their grade. Course participation is counted as sharing an interesting article that pertains to the chapters students are working on, or asking a question of other students to try to solve a difficult problem. Students can also answer their peers' questions by starting a thread under their post. Derogatory and sarcastic comments and jokes that marginalize anyone are fundamentally unacceptable, especially in the classroom. Offensive language—or language that could be construed as offensive—should be avoided.
10. **Administrative Drops** – Students who do not meaningfully participate by the time 20% of the term has passed will be administratively dropped from the course. For 15-week terms, the 20% mark is the third week of the course. Meaningful course participation includes regularly logging into the course, completing quizzes, engaging in the Discussion Community, and responding to Student Success outreach.
11. **Withdrawals** – If a student decides to exit from a course AFTER the drop deadline and BEFORE the withdrawal deadline, it is defined as a withdrawal. This is different from having

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dropped the course, as a grade of W will appear on the student's transcript. Withdrawals do not affect GPA, but they do count towards the number of credits attempted. Students will still have access to review the lectures and active learning, but progress in the course will not be saved. Students who Withdraw are not eligible for a refund.

12. **Disability Accommodations** – If a student has a request for reasonable disability accommodations, they should contact success@outlier.org and include specifics regarding the accommodation they are seeking. Additionally, students with a disability accommodations letter from a school they are currently attending should submit it as well. Outlier is committed to ensuring that learners with accessibility needs have equal opportunity to succeed in our courses.
13. **Religious Observances** – Outlier will make a reasonable attempt to accommodate student needs in the case of serious incompatibility between a student's religious creed and a scheduled test or examination. Students should make such requests via success@outlier.org during the first two weeks of an academic term.
14. **Transfer Credit** – University of Pittsburgh grades and credits earned in this course appear on an official University of Pittsburgh transcript, and the course credits are likely to be eligible for transfer to other colleges and universities. Students are encouraged to contact potential colleges and universities in advance to ensure their credits would be accepted. If students decide to attend any University of Pittsburgh campus, the University of Pittsburgh grade earned in the course will count toward the student grade point average at the University, and the earned credits will count towards the overall credits required for graduation. At the University of Pittsburgh, the grade from this course supersedes any equivalent AP credit.

Grading Criteria

A student's grade in this course will be comprised of the following elements:

- 5% Course participation in student group discussions
- 20% Midterm exams (two midterm exams, 10% each)
- 25% Final exam
- 50% Chapter quizzes (19 quizzes)

Quizzes

At the end of each chapter, each student is required to complete a quiz designed to assess their mastery of the material covered in that chapter. Each student will be able to attempt five (5) versions of each chapter's quiz:

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- Three (3) of these will be made available to the student at the end of each chapter
- One (1) will become available to the student when the midterm covering the material of that chapter is presented
- One (1) last version will become available to the student when the final is presented

For chapters with materials that are only covered on the final, the two (2) additional versions of those chapters' quizzes will become available to the student when the final is presented.

Each student is required to attempt and complete at least one version of each chapter's quiz. Failing to do so will result in a grade of 0% for that chapter. If a student completes more than one quiz for a chapter, only the highest grade achieved will be counted for that chapter. As such, the student is encouraged to use these multiple quiz attempts as opportunities to identify areas that are in need of further practice. This diligent effort will allow the student to improve their understanding, mastery of the material, and grade in the course.

Grades

An official grade will appear on the University of Pittsburgh transcript for any student who continues their enrollment beyond the official drop date for the course. Outlier.org will publicize the official drop date for each semester.

Grading Scale

A: 92.5 -100%
A-: 89.5 – 92.49%
B+: 86.5-89.49%
B: 82.5 – 86.49%
B-: 79.5 – 82.49%
C+: 76.5 – 79.49%
C: 72.5 – 76.49%
C-: 69.5 – 72.49%
D: 59.5 – 69.49%
F: 0 – 59.49%

Course Schedule

Chapter assignments and assessments subject to change, and will be announced through Outlier.org as applicable within a reasonable time frame. Academic discussion community participation points accrue throughout the course duration until the scheduled course end date, and students should aim to keep up with weekly responses to prompts and comments on classmates' posts. Quizzes may be completed at any

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time during the course duration once their corresponding chapter has been unlocked. All active learning, practice, and lectures are provided for students' learning and practice and are not time-sensitive or graded but should be completed within each week if possible.

Week	Chapter	Topics	Assignments
Week 1	1 - Introduction to Our Stellar Course	• A Tour of the Universe • The Science of Astronomy	Chapter 1 Quizzes Academic Discussion Community Post 1
Week 2	2 - Gathering, Detecting, and Interpreting Light	• What is Light? • Capturing Light • Instruments and Image Processing • Further Observational Techniques	Chapter 2 Quizzes Academic Discussion Community Post 2
Week 3	3 - Birth of Stars 4 - Stars: Analyzing Starlight and Celestial Differences	• Star Formation and Energy Sources • Nuclear Fusion • Stellar Census • Mass, Diameter, Brightness, and Distance • Star Colors and Spectra • The H-R Diagram and Cosmic Distances	Chapters 3 & 4 Quizzes Academic Discussion Community Post 3
Week 4	5 - The Origin of the Solar System	• Solar System Formation • Planetary Motion and Orbits • Planetary Formation	Chapter 5 Quizzes Academic Discussion Community Post 4
Week 5	6 - The Sun as a Star	• Observing the Sun • The Solar Cycle & Space Weather	Chapter 6 Quizzes Academic Discussion Community Post 5
Week 6	7 - Earth as a Planet 8 - Our Amazing Moon	• Geological Time and Plate Tectonics • Earth's Atmosphere and Climate Change • Impacts on the Earth	Chapters 7 & 8 Quizzes Academic Discussion Community Post 6

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		• Properties and Origin of the Moon • Moon Phases and Eclipses	
	1-8	Midterm Exam 1 opens at 12pm ET on Monday of Week 6	Midterm 1, Retake 1 - 8 Quizzes as needed
		Midterm Exam 1 closes at 12pm ET on Monday of Week 7	
Week 7	9 - The Inner Solar System	• Mercury and an Overview of the Nearest Planets • Venus: Earth's Sister Planet • The Exploration of Mars	Chapters 9 & 10 Quizzes
	10 - The Outer Solar System	• The Jovian Planets • Mysterious Outer Moons	Chapters 9 & 10 Quizzes Academic Discussion Community Post 7
Week 8	11 - Exoplanets	• Exoplanets: The Search Beyond Our Solar System • Astrobiology and Life in the Universe	Chapter 11 Quizzes Academic Discussion Community Post 8
Week 9	12 - The Life Cycles of Stars	• The Main Sequence to Red Giants • Evolution of Other Stars	Chapter 12 Quizzes Academic Discussion Community Post 9
Week 10	13 - Dead Stars 14 - The Milky Way	• Stellar Death and Supernovae • Observations of Stellar Remnants • Characteristics of Our Milky Way • Origin & Formation of the Milky Way	Chapters 13 & 14 Quizzes Academic Discussion Community Post 10
Week 11	9-14	Midterm Exam 2 opens at 12pm ET on Monday of Week 11	Midterm 2, Retake Chapters 9 - 14 Quizzes as needed

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		Midterm Exam 2 closes at 12pm ET on Monday of Week 12	Academic Discussion Community Post 11
Week 12	15 - Black Holes 16 - Galaxies & Our Expanding Universe	• General Relativity • Evidence for Black Holes • Quasars and Supermassive Black Holes • Galaxy Basics • Universe Expansion and the Cosmic Microwave Background	Chapters 15 & 16 Quizzes Academic Discussion Community Post 12
Week 13	17 - Large Scale Structure And Cosmology 18 - Dark Matter, Dark Energy, and the Fate of the Universe	• Galaxy Observations • Galaxy Mergers and Distribution • The Composition of the Universe • The Structure of the Universe • The Age of the Universe	Chapters 17, 18.1, & 18.2 Quizzes Academic Discussion Community Post 13
Week 14	1 - 18	Final Exam opens at 12pm ET on Monday of Week 14	Final Exam, Retake Chapters 1 -18 Quizzes as needed Academic Discussion Community Post 14
		Final Exam closes at 12pm ET on Monday of Week 15 All quizzes close at 12pm ET on Monday of Week 15 Discussion community participation point earning period ends at 12pm ET on Monday of Week 15	

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