

PTYS 170A1 – Alien Earths

Tier-One General Education Course

Tues,Thurs 9:30 – 10:45 am in Kuiper Space Sciences Room 308

Instructor: Prof. Renu Malhotra, malhotra@arizona.edu, [website](#)

Office Hours: will be announced on D2L.

Teaching Assistants:

Teaching assistant office hours will be listed on the D2L website.

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Part 1: Course summary and logistics

Course Description: Thousands of planets have been discovered orbiting nearby stars. How many of these worlds can we expect to be Earth-like? We explore this question from the perspective of astronomers, geologists, and historians. We look back at Earth's geologic history to periods when our planet itself would appear very alien to us today. We study the nearby planets Venus and Mars, which were once more Earth-like than today. We discuss not only the evolution of Earth, Venus, and Mars as habitable worlds but also how human understanding of these planets has evolved. Finally, we apply these perspectives to the search for alien Earths in our galaxy. This interdisciplinary treatment of Earth, its neighboring planets, and planets being discovered around nearby stars allows us to consider the potentially unique position of Earth as a habitable world not only in space but in time.

Course Objectives: During the course, students will:

1. Demonstrate the methodologies and knowledge that characterize the perspective of astronomers in the context of searching for planets orbiting around other stars in our galaxy – including how this astronomical perspective has changed over many generations of astronomers.
2. Demonstrate the methodologies and knowledge that characterize the perspective of geologists in the context of exploring Earth's geologic record as well as those of Venus and Mars – including how this geological perspective has changed over many generations of geologists.
3. Synthesize the perspectives of astronomers and geologists to describe the importance of both space and time in finding truly Earth-like planets around other stars.
4. Obtain their own data – such as quantitative information from in-class demonstrations and assignments, etc.
5. Critically analyze and interpret observations, measurements, and quantitative data in the context of understanding Earth as a habitable planet.
6. Communicate with peers and/or non-experts – through written essays and recorded video presentations – their analysis and interpretation of their own data as well as data provided from primary sources.

Expected Student Learning Outcomes: Upon successful completion of the course students will be able to

1. Communicate the general concepts relevant to the evolution of Earth and Earth-like planets in our solar system and around other stars,

2. Write about the approaches and methodologies of astronomers and geologists, and the benefits of these diverse perspectives,
3. Demonstrate competency in working with numerical information by critically analyzing quantitative information, generating ideas that are supported by quantitative evidence, assessing the relevance of data and its implications in a variety of contexts, and communicating those ideas and/or associated interpretations using various formats (e.g., written papers, recorded video presentations, use of graphs and/or tables),
4. Effectively communicate an understanding of these concepts to their peers by writing in a variety of contexts and through consistent use of specific conventions of organization, design, style, mechanics and citation format while reflecting on their writing development, and
5. Demonstrate practical skills with a variety of software, such as Word, Excel, Keynote, PowerPoint, and image/video editing apps.

Course website: This course will use D2L for assignments, lecture notes, and communications. Assignments will also be submitted through D2L unless otherwise noted.

Course Communications: Course announcements will be posted on D2L and announced in class. If we need to contact you for any reason we will use your university email, so please check it regularly. If you have any questions, comments, or concerns, please email Prof. Malhotra or the TAs, or talk to us before or after class, or come to office hours.

Required Texts and Materials: There is no textbook. You will need a device capable of internet access (phone, tablet, laptop) to get credit for in-class participation via Top Hat. You will also need pens/pencils for the in-class work. A calculator or calculator app on your phone or laptop may also be useful.

Honors Credit: As this is a GenEd course, it is available for Honors credit with an [Honors contract](#). Contact the instructor to discuss your ideas for an honors contract.

Part 2: Course Assessment and Grading

There is no final exam in this class. Grading and assessment will be based on in-class work, homework essays, and a Signature Assignment.

In-class work: During class meetings, we will use [Top Hat](#) for in-class participation and responses; *your participation will be recorded*. There will also be in-class activities that will require work in small groups. These will involve elements of logical reasoning and quantitative analysis and/or group discussion and must be turned in by the end of class. The in-class work will account for 20% of the grade. This grade component reflects your efforts in coming to class and actively engaging with the course material.

If you know you will miss class due to illness or university-approved activity and need to make up in-class work, please email Prof. Malhotra in advance so a time can be arranged. These make-ups will occur during office hours or an arranged meeting time.

Homework and Late Policy: There will be 6 homework assignments throughout the semester, and they will be posted in advance on the D2L website. The homework will consist of written short responses or short (one page) essays. You may discuss the homework assignment with other students but the work that you turn in for grading must be in your own words. Each homework assignment will have at least

one week for completion, will be graded over the next week, and returned to you. Late homework will incur a 5% penalty for up to 24 hours late, and a 10% penalty for each day subsequent day. Homework will be accepted more than 1 week late without the approval of the instructor. The first two homework assignments will be eligible for revisions for grade improvement; details on this will be provided in class. The homework component will account for 40% of the grade.

Signature Assignment: This GenEd course will have a Signature final project that will involve researching material relating to the course and applying this information to produce a final project report. The Signature Assignment will be due at the end of the semester and will account for 40% of the grade.

Grade components

In-class work	20%
Homework	40%
Signature Assignment	40%

Final letter grades will be calculated to the nearest 0.1% and will be assigned as follows.

A: 90.0% or higher
B: 80.0 – 89.9%
C: 70.0 – 79.9%
D: 60.0 – 69.9%
E: Below 60.0%

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal>.

Regrades: All your work will be graded by a teaching assistant or by Prof. Malhotra. Although we will make every effort to evaluate your work thoroughly and fairly, sometimes human error can occur. If you think there is an error in grading your homework or in-class work, please contact the TAs first. If you have a question about a grade, or cannot resolve a grade with the TAs, please contact Prof. Malhotra. We will look at your work again and return it to you with a response, usually within a week. *You must report any grading errors within a week of the return of your assignment to receive a regrade.*

Part 3: Course policies

Absence and Class Participation Policy: Participating in the course and attending lectures and other course events are vital to the learning process.

- The UA's policy concerning Class Attendance and Participation is available at: <https://catalog.arizona.edu/policy/courses-credit/courses/class-attendance-participation>. Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored.
- The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Please do not come to class while you are sick! Lecture slides will be posted on D2L. With sufficient advanced notice we can arrange a remote call-in to lecture if you are well enough to participate virtually. Please email the instructor to discuss plans if you will miss significant class time.

Makeup Policy for students who register late: Students who register by the end of the second week of class may be given an opportunity to make up missed work within a reasonable amount of time, to be mutually agreed upon by the student and instructor.

Classroom behavior policy: Department policy *forbids any outside food or drink, except water, in the lecture hall*. We all have a shared responsibility to create a positive learning environment free from distractions. Extraneous activities (e.g., texting, gaming, online shopping, etc.) are not acceptable during class time. If you arrive late to class or need to leave early, please choose a seat on the aisle and enter/exit quietly. Please silence your phone during class. If you need to accept an emergency phone call, please exit the lecture hall fully before talking on the phone. Behaviors that could be disruptive to other students are not acceptable, and disruptive students will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave, may lose participation points for that class, and may be reported to the Dean of Students. Examples of potentially disruptive behaviors include chatting, making phone calls, watching movies, tv or video clips, and live streaming or video recording.

Academic integrity: Both students and faculty are bound by the University's Code of Academic Integrity, which covers many forms of academic dishonesty. Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. This means that work submitted in your name must be the result of your own scholarly efforts. Details on the code of academic integrity are available at:

<https://deanofstudents.arizona.edu/policies/code-academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, see:

<https://lib.arizona.edu/research/citing/plagiarism>.

Use of AI tools: Every writing assignment will have a description of how AI tools (e.g., ChatGPT) are to be used or avoided. All AI contributions to assignments should be clearly identified in submitted work. Inappropriate use of AI tools will be considered a violation of the Code of Academic Integrity, specifically the prohibition against submitting work that is not your own.

UA Policies and Student Resources: All UA courses adhere to the general UA Policies as stated on the institutional websites: <https://catalog.arizona.edu/policies>. This site also includes a list of student resources.

Accessibility and Accommodations: At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, <https://drc.arizona.edu/>) to establish reasonable accommodations. Please be aware that the accessible seating in our classroom should remain available for students who find that standard classroom seating is not usable.

Course Climate and Inclusion Statement: Students and instructors have a shared responsibility to foster a positive learning environment. Our focus is on creating an environment of good manners, kindness, respect, and sincere inquiry, so we can challenge ourselves to succeed.

Confidentiality of Student Records: All student records, not just grades but also any identifiable material submitted for credit, are handled according to FERPA guidelines, see: <https://www.registrar.arizona.edu/privacy-ferpa/ferpa>.

Subject to Change Statement: Information contained in the course syllabus, other than the grading and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

Part 4: Course schedule

An approximate schedule of topics and assignment due dates is listed below. An up-to-date course schedule and due dates will be available on D2L. Details are subject to change and D2L will always have the most current information.

Week	Topic	Assignment	Due at 5 pm on—
1 (1/16)	Introduction to course		
2 (1/21,1/23)	The Sun and Stars		
3 (1/28,1/30)	Light, energy and gravity	Homework	Jan. 30
4 (2/4,2/6)	History of the Solar System		
5 (2/11,2/13)	Geo-Age Dating	Homework	Feb. 13
6 (2/18,2/20)	Early Earth and Origin of Life		
7 (2/25,2/27)	Early life on Earth	Homework	Feb 27
8 (3/4,3/6)	Plate Tectonics		
(3/10-3/14)	Spring Break		
9 (3/18,3/20)	The oxygen revolution	Signature Project Proposal	Mar. 18
10 (3/25,3/27)	Mass extinctions	Homework	Mar. 27
11 (4/1,4/3)	Earth Climate history		
12 (4/8,4/10)	Venus as an Alien Earth	Homework	Apr. 10
13 (4/15,4/17)	Mars as an Alien Earth		
14 (4/22,4/24)	Exoplanets	Homework	Apr. 24
15 (4/29,5/1)	Ice- and Ocean Worlds		
16 (5/6)	Life in the Universe	Signature Project Report	May 7