MARS

PTYS-ASTR-GEOS 442/542

Spring semester 2026

Kuiper 312

Meeting times: MW 12:30-1:45 PM

Description of Course

In-depth study of the planet Mars, including geology, geophysics, atmospheric science, climate change, the search for life, and the history and future of Mars exploration. There will be guest lectures from professors and research scientists with expertise in various aspects of Mars. There will be discussions about recent results and scientific controversies.

Course Prerequisites or Co-requisites

The course is intended for upper division (442) and graduate (542) science majors or minors. Participants must have a strong undergraduate background in the physical sciences including several introductory courses in math, physics, geology, and either planetary science or astronomy.

Instructor and Contact Information

Professor Alfred McEwen
204 Sonett Building
(520)270-0701
amcewen@arizona.edu
Office Hours: After class, or email for appointment

Web information, https://pirlwww.lpl.arizona.edu/~mcewen/Mars-442-542/

Course Format and Teaching Methods

Lecture, seminar, small-group activities, in-class discussion

Course Objectives

The student who successfully completes this course should have a good basic understanding of all aspects of Mars (interior, surface, and atmosphere through time) and how it compares with Earth and other planets. The student should also understand the methods of exploration of a remote planet (remote sensing, surface landers and rovers, Mars meteorites, potential human exploration). Students should acquire a new understanding and appreciation for exploration and scientific research and sharpen their skills in critical thinking.

Expected Learning Outcomes

You will be able to distinguish fact from fiction about Mars.

You will be able to demonstrate your knowledge about the significance of current research in the field by presenting a research report.

You will be able to prepare and present effective, informative, and persuasive public speeches.

For graduate students: you will demonstrate the ability for critical and original thinking.

400/500 Co-convened Course Information

This is a combined class for graduate students and for upper-division undergraduates. The graduate students will be evaluated according to higher expectations and assignments. Student comments are commonly

that the course is taught at too high of a level for the undergraduates, and too low of a level for graduate students. There is no easy solution, but the more questions students ask the better. Also, this format has the advantage of exposing undergraduates to the abilities and thought processes of graduate students, which is helpful if they are considering graduate education for themselves.

Class Participation

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Absences may affect a student's final course grade. If you anticipate being absent or are unexpectedly absent, please contact the professor as soon as possible. To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu. If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

Course Communications

In addition to the classroom, online communication will be conducted via UA e-mail addresses and D2L.

Required or Recommended Texts or Readings

See https://pirlwww.lpl.arizona.edu/~mcewen/Mars-442-542/papers for all required materials. No purchases are necessary. Students will need to find additional resources for their class projects (with help as needed from the instructor), but still no purchases are needed.

Assignments and Examinations: Schedule/Due Dates

Homework will be assigned every few weeks in class (see Class Schedule). In general, this homework will be due two weeks from the date on which it is assigned. Some of these assignments may be based on analysis of spacecraft data and will require students to utilize computational resources such as the software HiView and JMars. We will devote a lecture to demonstrate this software. Late homework receives half credit and homework submitted a week or more after the due date receives no credit (barring special circumstances). If you are unable to complete a homework assignment on time (and have a good reason) you must discuss this with the instructor *before* the due date to avoid losing credit.

Homeworks and other assignments to be turned in here: https://d2l.arizona.edu/d2l/home/1707011

Each student will participate in targeting and analyzing your own HiRISE image of Mars. We will need to quickly get the candidate HiRISE targets defined for acquisition and analysis by April. Each student will write interpretations of their image after the data have been returned to Earth. Graduate students and undergraduate volunteers will present their interpretations to the class.

Graduate students will also be expected to lead a 30-minute class presentation and discussion about a Mars topic or current controversy of their choice (with instructor's concurrence).

You will be graded on class participation, including possible pop quizzes.

Examinations and Project

There will be one in-class mid-term exam in this course. Some questions will be similar to homework assignments.

A final course project (which may be an extension of the HiRISE image analysis) will be required of all students on some subject relevant to the content of the course. Students are encouraged to interact with

the instructor early in the semester to choose a topic for their project. A 10-15 minute oral presentation and 5-page written report on this project will be due at the end of the semester. **Please use AI to write the paper and then provide a critical evaluation of what the AI got correct and incorrect, and cite sources.** You will be graded on your critical evaluation of the AI report rather than the report itself. For undergraduates (442), this project may be a (thorough) literature review of a chosen topic. For graduate students (542), it should also contain original research or critical analysis. A more detailed explanation of expectations for undergraduate and graduate students will be provided. Original ideas are welcome.

Assessments

Final grades are determined from:

Homeworks	25%
HiRISE image report	15%
Class Participation (442/542) & 30-minute teaching presentation (542)	15%
Mid-term exam	15%
Final project - Oral	15%
Final project – written evaluation of AI-generated report	15%
There will be no final exam for this class	

Homework grades will be assigned according to the following scale.

90-100% A

80-89% B

70-79% C

60-69% D

50-59% E

Rubrics will be posted in the class website detailing how the HiRISE report and class project will be graded. Graduate student grades will be based on a higher level of expectation for the HiRISE report and Final project, and there may be extra questions for graduates in the homework assignments.

University Policies

All university policies related to a syllabus are available at: https://catalog.arizona.edu/syllabus-policies.

Student Policies

See https://catalog.arizona.edu/policy/all for many important procedures, such as Change of Schedule (adding or dropping courses), and policies.

Scheduled Topics/Activities

See: https://pirlwww.lpl.arizona.edu/~mcewen/Mars-442-542/**schedule**
This will change as needed to accommodate guest speakers, so check it often.

Safety on Campus and in the Classroom

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): https://cirt.arizona.edu/case-emergency/overview

Also watch the video available at https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/common/learningeventdetail/crtfy000000000003560

Nondiscrimination and Anti-harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see: http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

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Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course.

Graduate Student Resources

University of Arizona's Basic Needs Resources page: http://basicneeds.arizona.edu/index.html