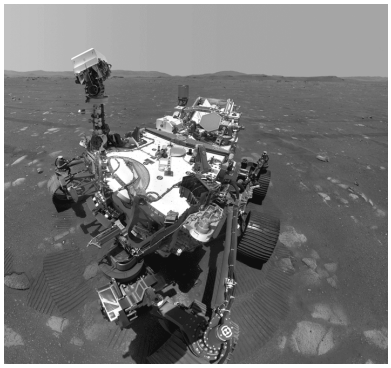
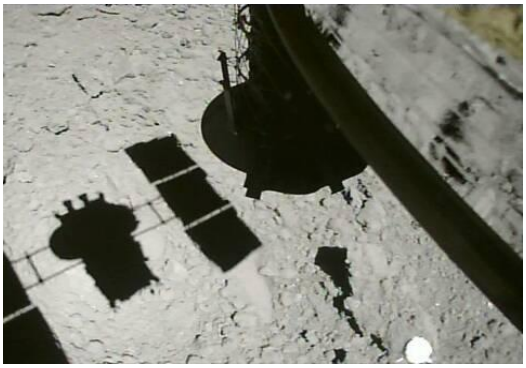

Fall 2021 ERTH 673 3 Credits

Planetary Systems: A Material View

Time: Tuesday and Thursday 9:00-10:15 AM, with exceptions for laboratory experiences
Location: *In Person:* POST 702 or 807
Primary Instructor: Eric Gaidos (gaidos@hawaii.edu)
Co-Instructors: Bin Chen, Elena Dobrica, Gary Huss
Office hours: by appointment
Course materials: Assigned readings in the literature

Motivation: How and from what "building blocks" did the Earth and other planets in the Solar System form? What factors governed their early evolution, with Earth alone becoming a habitable planet? How does this process unfold around other stars, and what are the implications for the occurrence of Earth-like, habitable planets elsewhere? Remote sensing in the Solar System and astronomical observations of exoplanets provide a framework for a theory of planetary origin and evolution in which such questions can be addressed. But *in situ measurements or laboratory analysis of fallen or returned samples* provide complementary, and in many cases, essential data; chemical or physical pathways, reservoirs, timescales, and dates. The long-standing and reliable source of extraterrestrial material has been meteorites, some of which originate from the Moon and Mars, but most are from the asteroid belt, and from unidentified parent bodies of an uncertain origin and which have often since been disrupted. Space missions are returning samples from specific, well-studied bodies beginning with the *Apollo* program, currently with the *OSIRIS-REx*, *Hayabusa-2*, and *Chang'e-5* missions and in the future with *Martian Moons eXploration* mission and with sample caching by the *Perseverance* rover for later return. Advances in instrumentation and measurement technology have dramatically expanded our ability to "do more with less", but there will always be limitations on the quantity, types of samples, and in the case of meteorites, their precise origin.

Course prerequisites: Undergraduate degree in physics, chemistry, astronomy, astrophysics, earth or planetary science **AND** at least one of the following courses or their equivalents: ERTH 404 Planetary Surfaces, ERTH 466/666 Planetary Geology, ERTH 657 Astrochemistry, ERTH 669 Cosmochemistry, ASTR 430/630 The Solar System; **OR** permission of instructor.

The course consists of three parallel activities:

(1) Reading, presentation, and discussion of select journal articles on the science enabled by the study of meteorites and returned samples.
(2) Laboratory experiences to acquaint students with measurement techniques used to study extraterrestrial materials.
(3) As a student team, writing a proposal for the analysis of samples returned from Mercury by a hypothetical future mission.

Grading: Letter grade only
Course participation: 30%
Assigned problems: 30%
Team Project: 40%

Student learning outcomes:

- Learn key principles of the science enabled by extraterrestrial samples
- Acquire knowledge and experience with key analytical tools
- Develop teamwork and organizational skills to carry out a project
- Improve scientific writing and presentation skills

Disability Access: The Department of Earth Sciences will make every effort to assist those with disability and related access needs. For confidential services, please contact the Office for Students with Disabilities (known as "Kokua") located in the Queen Lili'uokalani Center for Student Services (Room 013): 956-7511, kokua@hawaii.edu, www.hawaii.edu/kokua
Gender-Based Discrimination or Violence: University of Hawaii is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources to support and assist you. Staff can also direct you to community resources. If you wish to speak with someone confidentially, see contacts in the URL below.
If you wish to report an incident of sex discrimination or gender-based violence, contact: Dee Uwono, Title IX Coordinator, Hawai'i Hall 124, t9uhm@hawaii.edu, 808-956-2299. As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender- based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need. http://www.manoa.hawaii.edu/titleix/resources.html#confidential