

Syllabus

ERTH 701: Physics of Earth's Interior

Fall 2023 (Tu: 1:30-4:20 pm), POST 833

Course Instructor:

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ERTH 701 Physics of the Earth's Interior (3) Interpretation of geophysical and laboratory data to understand elastic and anelastic properties, composition, phase relationships, temperature distribution in the Earth. Pre: consent. (Alt. years)

Course Description

The great majority of the Earth and other Earth-like planets or moons is inaccessible to direct sampling. Our knowledge on the physics and chemistry of Earth's and planetary interiors has relied on multidisciplinary investigations from seismology, geodynamics, and geochemistry, as well as mineral physics. Mineral physics plays a central role in Earth and planetary sciences by linking materials properties of planetary constituents with large-scale geological and planetary processes and seismic and astronomical observations. It provides essential information on materials properties for the understanding of the nature and dynamics of planetary interiors. Beyond geology, it has many relevant connections with development of new advanced materials for technological applications, such as superconductors, ferroelectrics, abrasives, etc. The course will be a hybrid lecture, discussion, and hands-on exercises format: organized lectures given by the instructor alternating with group discussion of classical and current papers and group or individual modeling/computation and laboratory projects.

Readings and References:

1. Theory of the Earth (Don L. Anderson), free electronic version is available at <http://authors.library.caltech.edu/25018/>.
2. Poirier J.-P (2000) Introduction to the Physics of the Earth's interior. Cambridge University Press.
3. Specific reading assignments and lecture notes/Powerpoint slides will be posted online on *Laulima*.

Grading:

Course grades will be based on class participation (20%), homework assignments (30%), final presentation (20%), and final term paper (30%).

Course Objectives:

- (1) Review the current models and unsolved problems/questions regarding the composition and dynamics of the deep interiors of the terrestrial planets and terrestrial-like planetary bodies,
- (2) introduce the relevant experimental, theoretical, and analytical techniques in mineral physics and experimental petrology,
- (3) involve mineral physics modeling using Python or Jupyter notebook, and/or hands-on experiments in the Multi-Anvil Press Laboratory (MAPLab) and Laser Spectroscopy Laboratory.

Student Learning Objectives (SLOs)

The course aims to focus on the following student learning objectives established by the Department of Earth Sciences:

- SLO2: Students can apply technical knowledge of relevant computer applications, laboratory methods, field methods, and the supporting disciplines (math, physics, chemistry, biology) to solve real-world problems in geology and geophysics;

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- SLO3: Students use the scientific method to define, critically analyze, and solve a problem in Earth science;
- SLO4: Students can reconstruct, clearly and ethically, geological knowledge in both oral presentations and written reports;
- SLO5: Students can evaluate, interpret, and summarize the basic principles of geology and geophysics, including the fundamental tenets of the sub-disciplines, and their context in relationship to other core sciences, to explain complex phenomena in geology and geophysics.

In particular, students will employ mineral physics software packages and write their own programming codes to construct mineral physics or thermodynamic models for the Earth's and planetary interiors (SLO2, SLO3). They will also lead literature discussion and reports on classical and recent mineral physics publications (SLO4) and review the uncharted areas and unanswered questions in the field (SLO5). The course will also offer opportunities for students to conduct class project(s) using the computational, experimental, and analytical facilities related to mineral physics research and apply the mineral physics knowledge for the understanding of some specific problems on the physics and chemistry of the Earth and planetary interiors (SLO2, SLO3, SLO4, SLO5).

Disability Access:

If you have a disability and related access needs the Department will make every effort to assist and support you. For confidential services students are encouraged to contact the Office for Students with Disabilities (known as "Kokua") located on the ground floor (Room 013) of the Queen Lili'uokalani Center for Student Services: KOKUA Program; 2600 Campus Road; Honolulu, Hawaii 96822 Voice: 956-7511; Email: kokua@hawaii.edu; URL: www.hawaii.edu/kokua. Please know that course instructor Bin Chen will work with you and KOKUA to meet your access needs.

Title IX:

The University of Hawai'i 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 on your campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

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.

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, use the confidential resources available here:

<http://www.manoa.hawaii.edu/titleix/resources.html#confidential>

If you wish to directly REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support, contact: Jennifer Rose Title IX Coordinator (808) 956-2299 t9uhm@hawaii.edu.

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Basic Needs:

Basic needs include food and housing, childcare, mental health, financial resources and transportation, among others. Student basic needs security is critical for ensuring strong academic performance, persistence and graduation and overall student well-being. If you or someone you know is experiencing basic needs insecurity, please see the following resources: <https://www.hawaii.edu/student-basic-needs/resources/manoa/>.