

# Earth and Planetary Science

The Department of Earth and Planetary Sciences offers a PhD degree in Earth and Planetary Science. The central objective of the graduate program is to encourage creative thinking and develop the capacity for independent and original research. A strong undergraduate background in the physical sciences is especially helpful, and a significant number of our graduate students have their training in physics, chemistry, mathematics, engineering, or astronomy. Graduate students are formally accepted into the Earth and Planetary Science program, and they normally work directly toward a PhD.

The department offers a one-year MA program; however, admission to the program is available only to graduates of our bachelor's degree program in Earth and Planetary Science. We do not accept applications to the MA program from other majors or universities.

## Admission to the University

### Minimum Requirements for Admission

The following minimum requirements apply to all graduate programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A grade point average of B or better (3.0);
3. If the applicant has completed a basic degree from a country or political entity (e.g., Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 90 on the iBT test, 570 on the paper-and-pencil test, or an IELTS Band score of at least 7 on a 9-point scale (note that individual programs may set higher levels for any of these); and
4. Sufficient undergraduate training to do graduate work in the given field.

### Applicants Who Already Hold a Graduate Degree

The Graduate Council views academic degrees not as vocational training certificates, but as evidence of broad training in research methods, independent study, and articulation of learning. Therefore, applicants who already have academic graduate degrees should be able to pursue new subject matter at an advanced level without the need to enroll in a related or similar graduate program.

Programs may consider students for an additional academic master's or professional master's degree only if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of

knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.

2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may apply only to one single degree program or one concurrent degree program per admission cycle.

## Required Documents for Applications

1. **Transcripts:** Applicants may upload *unofficial* transcripts with your application for the departmental initial review. Unofficial transcripts must contain specific information including the name of the applicant, name of the school, all courses, grades, units, & degree conferral (if applicable).
2. **Letters of recommendation:** Applicants may request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, by the recommender, not the Graduate Admissions.
3. **Evidence of English language proficiency:** All applicants who have completed a basic degree from a country or political entity in which the official language is not English are required to submit official evidence of English language proficiency. This applies to institutions from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, most European countries, and Quebec (Canada). However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a US university may submit an official transcript from the US university to fulfill this requirement. The following courses will not fulfill this requirement:

- courses in English as a Second Language,
- courses conducted in a language other than English,
- courses that will be completed after the application is submitted, and
- courses of a non-academic nature.

Applicants who have previously applied to Berkeley must also submit new test scores that meet the current minimum requirement from one of the standardized tests. Official TOEFL score reports must be sent directly from Educational Test Services (ETS). The institution code for Berkeley is 4833 for Graduate Organizations. Official IELTS score reports must be sent electronically from the testing center to University of California, Berkeley, Graduate Division, Sproul Hall, Rm 318 MC 5900, Berkeley, CA 94720. TOEFL and IELTS score reports are only valid for two years prior to beginning the graduate program at UC Berkeley. Note: score reports can not expire before the month of June.

## Where to Apply

Visit the Berkeley Graduate Division application page (<http://grad.berkeley.edu/admissions/apply/>).

Candidates for the PhD degree must pass the oral qualifying examination by the end of the second year and complete a thesis to the satisfaction of the appointed thesis committee. Students must have two research

propositions to present at the qualifying examination, each developed under the supervision of a different professor on substantially different topics. There are no required courses for the PhD program.

The master of arts degree requires 24 semester units of upper division and graduate courses with at least 12 units of graduate coursework, followed by a comprehensive oral examination.

Research units can count toward the 24 total, but not toward the 12 grad level. 200-level seminars can only be counted toward the total 24 credits if they require active student participation in a focused topic area (e.g. pass/fail seminars in which students passively listen do not qualify).

Specifically:

- EPS 255 (Department Seminar), EPS 260 (intro to faculty research for 1st-year PhD students), EPS 254 (BSL seminar), EPS 298 (BASC seminar), EPS 290 research group meetings, and similar seminars cannot be used to satisfy MA requirements.
- EPS 256 (Earthquake of the Week) can be used if taken for a letter grade.
- EPS 290 courses can be used only if they have a focus and title that distinguishes them from research group meetings. E.g. in Fall 2020 Bruce Buffett taught "Computational Methods in GFD" as EPS 290, and William Boos taught "Global Circulation of Planetary Atmospheres" as EPS 290; both could be used toward the grad-level MA credits.
- EPS 280 (research with a faculty advisor) can be used for up to 6 units total, but may not be counted toward the 12 grad-level credits required for the MA (they can count toward the 24 unit total).

Your faculty advisor and the graduate student services advisor will need to approve your courses for the MA.

**The MA program is open only to students who have completed their undergraduate degree in our department.**

## Curriculum

Electives, as per specialized study list 24

12 units must be graduate courses

12 additional units may be graduate or upper division courses

EPS 200	Problems in Hydrogeology	4
EPS 204	Elastic Wave Propagation	3
EPS 203	Introduction to Aquatic and Marine Geochemistry	4
EPS 207	Laboratory in Observational Seismology	3
EPS 209	Matlab Applications in Earth Science	2
EPS 210	Exploration, Ore Petrology, and Geochemistry	4
EPS 212	Advanced Stratigraphy and Tectonics	3
EPS 214	Igneous Petrology	4
EPS 216	Active Tectonics	3
EPS 217	Fluvial Geomorphology	4
EPS 220	Advanced Concepts in Mineral Physics	3
EPS 224	Isotopic Geochemistry	4
EPS 225	Topics in High-Pressure Research	2
EPS 229	Introduction to Climate Modeling	3
EPS 230	Radiation and Its Interactions with Climate	3
EPS 236	Geological Fluid Mechanics	4

EPS C241	Stable Isotope Ecology	5
EPS C242	Glaciology	4
EPS C249	Solar System Astrophysics	3
EPS 250	Advanced Topics in Earth and Environmental Sciences	3
EPS 251	Carbon Cycle Dynamics	3
EPS 254	Advanced Topics in Seismology and Geophysics	1
EPS 255	Advanced Topics in Earth and Planetary Science	1
EPS 256	Earthquake of the Week	2
EPS 260	Research in Earth Science	2
EPS 271	Field Geology and Digital Mapping	4
EPS C276	Seismic Hazard Analysis and Design Ground Motions	3
EPS 280	Research	1-12
EPS 290	Seminar	1-6
EPS C292	Planetary Science Seminar	1
EPS C295Z	Energy Solutions: Carbon Capture and Sequestration	3
EPS 298	Directed Group Study for Graduates	1-9

## Earth and Planetary Science

Expand all course descriptions [+] Collapse all course descriptions [-]

### EPS 200 Problems in Hydrogeology 4 Units

Terms offered: Spring 2022, Spring 2021, Fall 2019

Current problems in fluid flow, heat flow, and solute transport in the earth. Pressure- and thermal-driven flow, instability, convection, interaction between fluid flow and chemical reactions. Pore pressure; faulting and earthquakes; diagenesis; hydrocarbon migration and trapping; flow-associated mineralization; contaminant problems.

Problems in Hydrogeology: Read More [+]

#### Rules & Requirements

**Prerequisites:** Physics 7A-7B, Chemistry 1A-1B, Math 53 and 54; open to senior undergraduates with appropriate prerequisites

#### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics C200 and Geology C200

Problems in Hydrogeology: Read Less [-]

## EPS 203 Introduction to Aquatic and Marine Geochemistry 4 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

Introduction to marine geochemistry: the global water cycle; processes governing the distribution of chemical species within the hydrosphere; ocean circulation; chemical mass balances, fluxes, and reactions in the marine environment from global to submicron scales; carbon system equilibrium chemistry and biogeochemistry of fresh and salt water; applications of natural and anthropogenic stable and radioactive tracers; internal ocean processes. Students participate in a one day field trip to sample and analyze waters in the vicinity of Tomales Bay and Point Reyes. 3 hours of lecture and 1.5 hours of discussion week, and a 10 hour field trip.

Introduction to Aquatic and Marine Geochemistry: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Chemistry 1A, Mathematics 1A, or 16A. C82 recommended

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Bishop

Introduction to Aquatic and Marine Geochemistry: [Read Less](#) [-]

## EPS 204 Elastic Wave Propagation 3 Units

Terms offered: Fall 2012, Fall 2007, Fall 2004

Wave propagation in elastic solids; effects of anelasticity and anisotropy; representation theorems; reflection and refraction; propagation in layered media; finite-difference and finite-element methods.

Elastic Wave Propagation: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** 104 or equivalent; 121; Physics 105

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 204

Elastic Wave Propagation: [Read Less](#) [-]

## EPS 207 Laboratory in Observational Seismology 3 Units

Terms offered: Fall 2023, Spring 2022, Spring 2021

Group problem solving of current seismological topics. Analysis, inversion, and numerical modeling of seismic waveform data to investigate questions regarding the physics of the earthquake source and seismic wave propagation. Application of current developments and techniques in seismological research.

Laboratory in Observational Seismology: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** 121 or 130 or 204 or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 207

Laboratory in Observational Seismology: [Read Less](#) [-]

## EPS 209 Matlab Applications in Earth Science 2 Units

Terms offered: Spring 2011, Fall 2002

Introduction to Matlab programming with toolboxes. Applications come from Earth sciences and related fields including biology. Topics range from image processing, riverbed characterization, landslide risk analysis, signal processing, geospatial and seismic data analysis, and machine learning to parallel computation. Designed for beginning graduate students.

Matlab Applications in Earth Science: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Some programming experience in any language

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 1 hour of laboratory per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

Matlab Applications in Earth Science: [Read Less](#) [-]

## EPS 210 Exploration, Ore Petrology, and Geochemistry 4 Units

Terms offered: Fall 2012, Fall 2011, Spring 2010

Overview of geological, petrological, and geochemical analysis of ore forming processes including sedimentary, magmatic, hydrothermal, and geothermal resources. Geochemical rock buffers and hydrothermal phase equilibria. Electro-geochemistry of near surface oxidation of primary ores related to climate change, hydrological evolution, and tectonics. Exploration for earth materials for conventional and sustainable technologies including multiple junction semiconductor photo-voltaic cells. Mass balance modeling of ore-forming systems and soils. Environmental management of exploration sites. Lab includes macroscopic and X-ray identification of ore and alteration minerals and ore microscopy. Field trips use digital GIS mapping methods for rock type, structure, mineralization, and wall rock alteration. Integration interpretation of geophysics with geology.

Exploration, Ore Petrology, and Geochemistry: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** 101 or 271; 100A-100B; 118 recommended

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Brimhall

**Formerly known as:** Geology 205

Exploration, Ore Petrology, and Geochemistry: Read Less [\[-\]](#)

## EPS 212 Advanced Stratigraphy and Tectonics 3 Units

Terms offered: Spring 2011, Spring 2009, Spring 2008

Evolution of the earth in response to internal, surficial and extraterrestrial processes.

Advanced Stratigraphy and Tectonics: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of seminar per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 212

Advanced Stratigraphy and Tectonics: Read Less [\[-\]](#)

## EPS 214 Igneous Petrology 4 Units

Terms offered: Spring 2020, Spring 2017, Spring 2014

The composition, generation, and cooling of magmas to form igneous rocks. The physical and thermodynamic properties of silicate liquids.

Igneous Petrology: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 4 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 214

Igneous Petrology: Read Less [\[-\]](#)

## EPS 216 Active Tectonics 3 Units

Terms offered: Fall 2023, Fall 2021, Fall 2018

This course is a graduate course designed to introduce students in the earth sciences to the geology of earthquakes, including tectonic geomorphology, paleoseismology and the analysis and interpretation of geodetic measurements of active deformation. While the focus will be primarily on seismically active faults, we will also discuss deformation associated with landslides, regional isostatic rebound, and volcanoes, as well as measurements of global plate motions. We will address methods and applications in paleoseismology, tectonic geomorphology, and geodesy. The course will address measurement techniques (e.g., GPS, leveling, etc.), data analysis and inversion, and subsequent modeling and interpretation of the data. The integration of geodetic measurements with geologic and seismologic data allows an improved understanding of active processes.

Active Tectonics: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** 116 or equivalent, Physics 7A or equivalent, or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 207

Active Tectonics: Read Less [\[-\]](#)

## EPS 217 Fluvial Geomorphology 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

Application of fluid mechanics to sediment transport and development of river morphology. Form and process in river meanders, the pool-riffle sequence, aggradation, grade, and baselevel.

Fluvial Geomorphology: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 217

Fluvial Geomorphology: Read Less [\[-\]](#)

## EPS 220 Advanced Concepts in Mineral Physics 3 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021

A combined seminar and lecture course covering advanced topics related to mineral physics. The interface between geophysics with the other physical sciences is emphasized. Topics vary each semester.

Advanced Concepts in Mineral Physics: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 220

Advanced Concepts in Mineral Physics: Read Less [\[-\]](#)

## EPS 224 Isotopic Geochemistry 4 Units

Terms offered: Spring 2023, Spring 2021, Spring 2020

An overview of the use of natural isotopic variations to study earth, planetary, and environmental problems. Topics include geochronology, cosmogenic isotope studies of surficial processes, radiocarbon and the carbon cycle, water isotopes in the water cycle, and radiogenic and stable isotope studies of planetary evolution, mantle dynamics, volcanoes, groundwater, and geothermal systems. The course begins with a short introduction to nuclear processes and includes simple mathematical models used in isotope geochemistry.

Isotopic Geochemistry: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Chemistry 1A-1B, Mathematics 1A-1B

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** David Shuster

Isotopic Geochemistry: Read Less [\[-\]](#)

## EPS 225 Topics in High-Pressure Research 2 Units

Terms offered: Spring 2023, Spring 2022, Fall 2021

Analysis of current developments and techniques in experimental and theoretical high-pressure research, with applications in the physical sciences. Topics vary each semester.

Topics in High-Pressure Research: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 225

Topics in High-Pressure Research: Read Less [\[-\]](#)



## EPS 229 Introduction to Climate Modeling 3 Units

Terms offered: Fall 2023, Fall 2022, Spring 2021

This course emphasizes the fundamentals of the climate system via a hierarchy of climate models. Topics will include energy balance, numerical techniques, climate observations, atmospheric and oceanic circulation and heat transports, and parameterizations of eddy processes. The model hierarchy will also explore nonlinear and stochastic processes, and biogeochemistry. Students will build computational models to investigate climate feedbacks, climate sensitivity, and response times. Introduction to Climate Modeling: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit with instructor consent.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Fung

**Formerly known as:** Earth and Planetary Science C229/Integrative Biology C229

Introduction to Climate Modeling: Read Less [-]

## EPS 230 Radiation and Its Interactions with Climate 3 Units

Terms offered: Fall 2023, Fall 2021, Fall 2019

Introduction to role of radiative processes in structure and evolution of the climate system. Electromagnetism; solar and terrestrial radiation; interactions of radiation with Earth's atmosphere, ocean, and land surface; greenhouse and runaway greenhouse effects; radiative balance of the climate system; energy-balance climate models; effects of clouds and aerosols; interactions of radiation with atmospheric and oceanic dynamics; radiative processes and paleoclimate; radiative processes and anthropogenic global warming. Radiation and Its Interactions with Climate: Read More [+]

### Rules & Requirements

**Prerequisites:** Physics 105, 110A, 110B

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Collins

Radiation and Its Interactions with Climate: Read Less [-]

## EPS 236 Geological Fluid Mechanics 4 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021

An advanced course in the application of fluid mechanics in the earth sciences, with emphasis on the design and scaling of laboratory and numerical models. Principals of inviscid and viscous fluid flow; dynamic similarity; boundary layers; convection; instabilities; gravity currents; mixing and chaos; porous flow. Applications to mantle convection, magma dynamics, atmosphere and ocean dynamics, sediment/debris flows, and hydrogeology. Topics may vary from year to year. Geological Fluid Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** Continuum/fluid mechanics at the level of 108 or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 238

Geological Fluid Mechanics: Read Less [-]

## EPS C241 Stable Isotope Ecology 5 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021, Spring 2020, Spring 2019, Spring 2016

Course focuses on principles and applications of stable isotope chemistry as applied to the broad science of ecology. Lecture topics include principles of isotope behavior and chemistry, and isotope measurements in the context of terrestrial, aquatic, and marine ecological processes and problems. Students participate in a set of laboratory exercises involving preparation of samples of choice for isotopic analyses, the use of the mass spectrometer and optical analysis systems, and the analysis of data. Stable Isotope Ecology: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructors:** Amundson, Dawson, Mambelli

**Also listed as:** ESPM C220/INTEGBI C227

Stable Isotope Ecology: Read Less [-]

## EPS C242 Glaciology 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2018, Spring 2017

A review of the mechanics of glacial systems, including formation of ice masses, glacial flow mechanisms, subglacial hydrology, temperature and heat transport, global flow, and response of ice sheets and glaciers. We will use this knowledge to examine glaciers as geomorphologic agents and as participants in climate change.

Glaciology: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Cuffey

**Formerly known as:** 241

**Also listed as:** GEOG C241

Glaciology: Read Less [-]

## EPS C249 Solar System Astrophysics 3 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017

The physical foundations of planetary sciences. Topics include planetary interiors and surfaces, planetary atmospheres and magnetospheres, and smaller bodies in our solar system. The physical processes at work are developed in some detail, and an evolutionary picture for our solar system, and each class of objects, is developed. Some discussion of other (potential) planetary systems is also included.

Solar System Astrophysics: Read More [+]

### Rules & Requirements

**Prerequisites:** 149, 169, C160A or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructors:** Chiang, de Pater

**Also listed as:** ASTRON C249

Solar System Astrophysics: Read Less [-]

## EPS 250 Advanced Topics in Earth and Environmental Sciences 3 Units

Terms offered: Fall 2016, Fall 2014, Fall 2013

Review of recent literature and discussion of ongoing research at the interface between earth science and environmental science.

Advanced Topics in Earth and Environmental Sciences: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of seminar per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 250

Advanced Topics in Earth and Environmental Sciences: Read Less [-]

## EPS 251 Carbon Cycle Dynamics 3 Units

Terms offered: Fall 2023, Fall 2021, Spring 2019

In this course, we will focus on the (unsolved) puzzle of the contemporary carbon cycle. Why is the concentration of atmospheric CO<sub>2</sub> changing at the rate observed? What are the terrestrial and oceanic processes that add and remove carbon from the atmosphere? What are the processes responsible for long-term storage of carbon on land and in the sea? Emphasis will be placed on the observations and modeling needed to evaluate hypotheses about carbon sources and sinks. Past records will be examined for clues about sensitivity of carbon processes to climate variations.

Carbon Cycle Dynamics: Read More [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 6 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 219

Carbon Cycle Dynamics: Read Less [-]

## EPS 254 Advanced Topics in Seismology and Geophysics 1 Unit

Terms offered: Fall 2023, Spring 2023, Fall 2022

Lectures on various topics representing current advances in seismology and geophysics, including local crustal and earthquake studies, regional tectonics, structure of the earth's mantle, and core and global dynamics.

Advanced Topics in Seismology and Geophysics: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 250

Advanced Topics in Seismology and Geophysics: [Read Less](#) [-]

## EPS 255 Advanced Topics in Earth and Planetary Science 1 Unit

Terms offered: Fall 2023, Spring 2023, Fall 2022

Lectures on various topics representing current advances in all aspects of earth and planetary science.

Advanced Topics in Earth and Planetary Science: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5 hours of colloquium per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Advanced Topics in Earth and Planetary Science: [Read Less](#) [-]

## EPS 256 Earthquake of the Week 2 Units

Terms offered: Fall 2023, Spring 2023, Fall 2022

Each week, the seismicity of the previous week, in California and worldwide, is reviewed. Tectonics of the region as well as source parameters and waveforms of interest are discussed and placed in the context of ongoing research in seismology.

Earthquake of the Week: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of discussion per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 255

Earthquake of the Week: [Read Less](#) [-]

## EPS 260 Research in Earth Science 2 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021

Weekly presentations to introduce new graduate students and senior undergraduates to current research conducted in the Department of Earth and Planetary Science.

Research in Earth Science: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Formerly known as:** Geology 260

Research in Earth Science: [Read Less](#) [-]



## EPS 271 Field Geology and Digital Mapping 4 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021

Geological mapping, field observation, and problem solving in the Berkeley hills and environs leading to original interpretation of geological processes and history from stratigraphic, structural, and lithological investigations. Integration of the Berkeley hills geology into the tectonic and paleo-climatic record of the Coast Ranges and California as a whole through systematic field mapping in key localities and reading of original literature. Training in digital field mapping, use of digital base maps, and use of global positioning systems.

Field Geology and Digital Mapping: Read More [+]

### Rules & Requirements

**Prerequisites:** 50 or equivalent introductory course for majors

**Credit Restrictions:** Students will receive no credit for 271 after taking 101.

### Hours & Format

**Fall and/or spring:** 15 weeks - 7 hours of fieldwork and 2 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Brimhall

Field Geology and Digital Mapping: Read Less [-]

## EPS C276 Seismic Hazard Analysis and Design Ground Motions 3 Units

Terms offered: Spring 2023, Spring 2021, Spring 2019

Deterministic and probabilistic approaches for seismic hazard analysis. Separation of uncertainty into aleatory variability and epistemic uncertainty. Discussion of seismic source and ground motion characterization and hazard computation. Development of time histories for dynamic analyses of structures and seismic risk computation, including selection of ground motion parameters for estimating structural response, development of fragility curves, and methods for risk calculations.

Seismic Hazard Analysis and Design Ground Motions: Read More [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Abrahamson

**Also listed as:** CIV ENG C276

Seismic Hazard Analysis and Design Ground Motions: Read Less [-]

## EPS 280 Research 1 - 12 Units

Terms offered: Fall 2023, Spring 2023, Fall 2022

Individual conferences to be arranged. Provides supervision in the preparation of an original research paper or dissertation.

Research: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-12 hours of independent study per week

### Summer:

6 weeks - 3-30 hours of independent study per week

8 weeks - 2-23 hours of independent study per week

10 weeks - 2-18 hours of independent study per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

Research: Read Less [-]

## EPS 290 Seminar 1 - 6 Units

Terms offered: Fall 2023, Spring 2023, Fall 2022

Topics will be announced each semester.

Seminar: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2-6 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 290

Seminar: Read Less [-]

## EPS C292 Planetary Science Seminar 1 Unit

Terms offered: Fall 2023, Spring 2023, Fall 2022

The departments of Astronomy and Earth and Planetary Science offer a joint research seminar in advanced topics in planetary science, featuring speakers drawn from graduate students, postdoctoral researchers, faculty, and visiting scholars. Topics will span planetary interiors; surface morphology; atmospheres; dynamics; planet formation; and astrobiology. Speakers will vary from semester to semester. Meetings will be held once a week for 1 hour each, and the schedule of speakers will be determined on the first day of class. To pass the class, participants will be required to give a 30-minute presentation, either on their own research or on recent results from the literature.

Planetary Science Seminar: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-1 hours of seminar per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Also listed as:** ASTRON C292

Planetary Science Seminar: [Read Less](#) [-]

## EPS C295Z Energy Solutions: Carbon Capture and Sequestration 3 Units

Terms offered: Fall 2018, Spring 2017, Spring 2015, Spring 2014, Spring 2013

After a brief overview of the chemistry of carbon dioxide in the land, ocean, and atmosphere, the course will survey the capture and sequestration of CO<sub>2</sub> from anthropogenic sources. Emphasis will be placed on the integration of materials synthesis and unit operation design, including the chemistry and engineering aspects of sequestration. The course primarily addresses scientific and engineering challenges and aims to engage students in state-of-the-art research in global energy challenges.

Energy Solutions: Carbon Capture and Sequestration: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Chemistry 4B or 1B, Mathematics 1B, and Physics 7B, or equivalents

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructors:** Bourg, DePaolo, Long, Reimer, Smit

**Also listed as:** CHEM C236/CHM ENG C295Z

Energy Solutions: Carbon Capture and Sequestration: [Read Less](#) [-]

## EPS 298 Directed Group Study for Graduates 1 - 9 Units

Terms offered: Fall 2023, Fall 2022, Spring 2022

Directed Group Study for Graduates: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** The grading option will be decided by the instructor when the class is offered.

**Formerly known as:** Geology 298

Directed Group Study for Graduates: [Read Less](#) [-]

## EPS C301 Communicating Ocean Science 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019, Spring 2015, Fall 2014, Spring 2014, Spring 2013

For graduate students interested in improving their ability to communicate their scientific knowledge by teaching ocean science in elementary schools or science centers/aquariums. The course will combine instruction in inquiry-based teaching methods and learning pedagogy with six weeks of supervised teaching experience in a local school classroom or the Lawrence Hall of Science with a partner. Thus, students will practice communicating scientific knowledge and receive mentoring on how to improve their presentations.

Communicating Ocean Science: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** One course in introductory biology, geology, chemistry, physics, or marine science required and interest in ocean science, junior, senior, or graduate standing; consent of instructor required for sophomores

### Hours & Format

**Fall and/or spring:** 15 weeks - 2.5 hours of lecture, 1 hour of discussion, and 2 hours of fieldwork per week

### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Professional course for teachers or prospective teachers

**Grading:** Letter grade.

**Instructor:** Ingram

**Also listed as:** GEOG C301/INTEGBI C215

Communicating Ocean Science: [Read Less](#) [-]

## **EPS 375 Professional Preparation: Supervised Teaching of Geology and Geophysics 1 - 6 Units**

Terms offered: Fall 2023, Fall 2021, Fall 2020

Discussion, curriculum, class observation, and practice teaching in geology, geophysics, and earth science.

Professional Preparation: Supervised Teaching of Geology and Geophysics: [Read More](#) [+]

### **Rules & Requirements**

**Prerequisites:** Graduate standing and appointment as graduate student instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### **Hours & Format**

**Fall and/or spring:** 15 weeks - 1 hour of discussion per week

### **Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Professional course for teachers or prospective teachers

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Formerly known as:** Earth and Planetary Science 300

Professional Preparation: Supervised Teaching of Geology and Geophysics: [Read Less](#) [-]