Planetary Science

Bachelor of Arts (BA)

Planetary science encompasses the study of the physical and chemical nature of planetary bodies both in the Solar System and in extrasolar systems. The formation of planets, the forces that sculpted their orbits, the processes that shaped their interiors, surfaces, and atmospheres and the development of life all fall under its rubric. Understanding these complex phenomena requires knowledge of astronomy and astrophysics, earth science, meteorology, atmospheric science, space science, plasma physics, chemistry, and biology. The Planetary Science major has been developed to study the remarkable interface among these disciplines.

Declaring the Major

Students are strongly encouraged to see the student services advisor as early as possible. Students are accepted into the major with a C average or better. There are a number of scholarships and research opportunities as well as other benefits available to declared majors.

Honors Program

Students in the honors program must fulfill the following additional requirements: 1) maintain a grade point average (GPA) of at least 3.3 in all courses in the major and an overall GPA of at least 3.3 in the University and 2) carry out an individual research or study project involving at least three units of EPS H195. The project is chosen in consultation with a departmental advisor, and the written report is judged by the student’s research supervisor and a departmental adviser.

Minor Program

For information regarding the requirements, please see the Minor Requirements tab. Program planning and confirmation should be done with the undergraduate major advisor and the planetary science faculty adviser.

Other Majors and Minors Offered by the Department of Earth and Planetary Science

Atmospheric Science (http://guide.berkeley.edu/undergraduate/degree-programs/atmospheric-science/) (Major and Minor)
Environmental Earth Science (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-earth-science/) (Major and Minor)
Geology (http://guide.berkeley.edu/undergraduate/degree-programs/geology/) (Major and Minor)
Geophysics (http://guide.berkeley.edu/undergraduate/degree-programs/geophysics/) (Major and Minor)
Marine Science (http://guide.berkeley.edu/undergraduate/degree-programs/marine-science/) (Major and Minor)

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a Pass/No Pass basis only. Other exceptions to this requirement are noted as applicable.
2. No more than two upper division courses may be used to simultaneously fulfill requirements for a student’s double major

and no more one course may be used to fulfill minor program requirements with the exception of minors offered outside of the College of Letters & Science.

3. A minimum grade point average (GPA) of 2.0 must be maintained in both upper and lower division courses used to fulfill the major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

Lower Division Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS 50</td>
<td>The Planet Earth</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1A</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1B</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 53</td>
<td>Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 54</td>
<td>Linear Algebra and Differential Equations (Choose one of the following physics sequences:)</td>
<td>4</td>
</tr>
</tbody>
</table>

or PHYSICS 89 Introduction to Mathematical Physics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1A</td>
<td>General Chemistry and General Chemistry Laboratory</td>
<td>5</td>
</tr>
<tr>
<td>&amp; 1AL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

or CHEM 4A General Chemistry and Quantitative Analysis

Choose one of the following physics sequences:

- PHYSICS 5A Introductory Mechanics and Relativity
- PHYSICS 5Band Introductory Electromagnetism, Waves, and Optics
- PHYSICS 5Cand Introduction to Experimental Physics I
- PHYSICS 5Cand Introductory Thermodynamics and Quantum Mechanics and Introduction to Experimental Physics II

PHYSICS 7A Physics for Scientists and Engineers

PHYSICS 7Band Physics for Scientists and Engineers

PHYSICS 7Cand Physics for Scientists and Engineers

Upper Division Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS 102</td>
<td>History and Evolution of Planet Earth</td>
<td>4</td>
</tr>
<tr>
<td>EPS 150</td>
<td>Case Studies in Earth Systems</td>
<td>2</td>
</tr>
<tr>
<td>EPS/ASTRON C162</td>
<td>Planetary Astrophysics</td>
<td>4</td>
</tr>
</tbody>
</table>

Electives: Select 14 upper division units from the following list of suggested courses: ¹

- EPS 117 Geomorphology [4]
- EPS 122 Physics of the Earth and Planetary Interiors [3]
- EPS 124 Isotopic Geochemistry [4]
- EPS 125 Stable Isotope Geochemistry [4]
- EPS C180 Air Pollution [3]
- or EPS C18 Atmospheric Physics and Dynamics
- or EPS C18 Atmospheric Physics and Dynamics Laboratory
- ASTRON 120 Optical and Infrared Astronomy Laboratory [4] (A choice of one of the following two:)
- or ASTRON Radio Astronomy Laboratory
Undergraduate students must fulfill the following requirements in addition to those required by their major program.

For detailed lists of courses that fulfill college requirements, please review the College of Letters & Sciences (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/) page in this Guide. For College advising appointments, please visit the L&S Advising (https://lsadvising.berkeley.edu/home/) Pages.

**University of California Requirements**

**Entry Level Writing** (http://writing.berkeley.edu/node/78/)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

**American History and American Institutions** (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/american-history-institutions-requirement/)

The American History and Institutions requirements are based on the principle that a US resident graduated from an American university, should have an understanding of the history and governmental institutions of the United States.

**Berkeley Campus Requirement**

**American Cultures** (http://americancultures.berkeley.edu/students/courses/)

All undergraduate students at Cal need to take and pass this course in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture of the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

**College of Letters & Science Essential Skills Requirements**

**Quantitative Reasoning** (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/quantitative-reasoning-requirement/)

The Quantitative Reasoning requirement is designed to ensure that students graduate with basic understanding and competency in math, statistics, or computer science. The requirement may be satisfied by exam or by taking an approved course.

**Foreign Language** (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/foreign-language-requirement/)

The Foreign Language requirement may be satisfied by demonstrating proficiency in reading comprehension, writing, and conversation in a foreign language equivalent to the second semester college level, either by passing an exam or by completing approved course work.

**Reading and Composition** (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/reading-composition-requirement/)

In order to provide a solid foundation in reading, writing, and critical thinking the College requires two semesters of lower division work in composition in sequence. Students must complete parts A & B reading...
and composition courses by the end of their second semester and a second-level course by the end of their fourth semester.

**College of Letters & Science 7 Course Breadth Requirements**

Breadth Requirements (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/#breadthrequirementstext)

The undergraduate breadth requirements provide Berkeley students with a rich and varied educational experience outside of their major program. As the foundation of a liberal arts education, breadth courses give students a view into the intellectual life of the University while introducing them to a multitude of perspectives and approaches to research and scholarship. Engaging students in new disciplines and with peers from other majors, the breadth experience strengthens interdisciplinary connections and context that prepares Berkeley graduates to understand and solve the complex issues of their day.

**Unit Requirements**

- 120 total units
- Of the 120 units, 36 must be upper division units
- Of the 36 upper division units, 6 must be taken in courses offered outside your major department

**Residence Requirements**

For units to be considered in "residence," you must be registered in courses on the Berkeley campus as a student in the College of Letters & Science. Most students automatically fulfill the residence requirement by attending classes here for four years. In general, there is no need to be concerned about this requirement, unless you go abroad for a semester or year or want to take courses at another institution or through UC Extension during your senior year. In these cases, you should make an appointment to meet an adviser to determine how you can meet the Senior Residence Requirement.

Note: Courses taken through UC Extension do not count toward residence.

**Senior Residence Requirement**

After you become a senior (with 90 semester units earned toward your BA degree), you must complete at least 24 of the remaining 30 units in residence in at least two semesters. To count as residence, a semester must consist of at least 6 passed units. Intercampus Visitor, EAP, and UC Berkeley-Washington Program (UCDC) units are excluded.

You may use a Berkeley Summer Session to satisfy one semester of the Senior Residence requirement, provided that you successfully complete 6 units of course work in the Summer Session and that you have been enrolled previously in the college.

**Modified Senior Residence Requirement**

Participants in the UC Education Abroad Program (EAP), Berkeley Summer Abroad, or the UC Berkeley Washington Program (UCDC) may meet a Modified Senior Residence requirement by completing 24 (excluding EAP) of their final 60 semester units in residence. At least 12 of these 24 units must be completed after you have completed 90 units.

**Upper Division Residence Requirement**

You must complete in residence a minimum of 18 units of upper division courses (excluding UCEAP units), 12 of which must satisfy the requirements for your major.

**Mission**

The goal of the Earth and Planetary Science (EPS) BA degree is to provide students with a broad and sound education that provides general and specialized knowledge and is intellectually challenging and stimulating. Upon completion of the degree students are ready to enter graduate school at top-ranking institutions (about half of them choose this path), find employment in the profession (geological and environmental engineering and consulting are major opportunities), continue in public education as teachers, or use their background as a sound basis for a new career such as in public policy, law or medical sciences.

**Learning Goals for the Major**

EPS majors acquire knowledge through course work, laboratory training (expertise in experimental techniques), primary field research, library research, and computer applications, with oral presentations and written reports required in many of our classes.

The undergraduate program provides strong technical training for those who wish to pursue professional careers in the earth, environmental, and planetary sciences as well as training in analytical, creative, and critical thinking and communication that serves well those who choose paths in new fields.

The field of Planetary Science encompasses the study of the physical and chemical nature of all planetary bodies both in our and other solar systems. The formation of planets, the forces that sculpted their orbits, the processes that shaped their interiors, surfaces, and atmospheres, and the development of life all fall under its rubric. Understanding these complex phenomena requires interdisciplinary knowledge of astronomy and astrophysics, earth science, atmospheric science, space science, and of fundamentals in physics and chemistry. The specialization prepares students for graduate school as well as employment in research laboratories and government agencies.

**Undergraduate Student Services**

epsua@berkeley.edu

**Faculty Advisor**

Professor Burkhard Militzer
militzer@berkeley.edu

**EPS Undergraduate Appointments**

To make an appointment, please visit the Contact Undergraduate Advisor website (http://eps.berkeley.edu/undergraduate/contact-undergraduate-advisor/)

**Planetary Science**

Expand all course descriptions [+])Collapse all course descriptions [-]
EPS 3 The Water Planet 3 Units
Terms offered: Spring 2021, Summer 2020 8 Week Session, Spring 2020
An overview of the processes that control water supply to natural ecosystems and human civilization. Hydrologic cycle, floods, droughts, groundwater. Patterns of water use, threats to water quality, effects of global climate change on future water supplies. Water issues facing California.
The Water Planet: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week
Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

The Water Planet: Read Less [-]

EPS 7 Introduction to Climate Change 3 Units
Terms offered: Fall 2021, Fall 2020, Fall 2019
This course covers the physical processes that determine Earth's past, present, and future climate, with a particular focus on the essentially irreversible climate change (a.k.a., global warming) caused by the burning of coal, oil, and natural gas. Topics will also include the estimation of future warming and impacts, the Earth resources that can be used to combat climate change, and the policies being used to shift towards the use of those resources.
Introduction to Climate Change: Read More [+]

Hours & Format

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

Additional Details

Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: David Romps

Introduction to Climate Change: Read Less [-]

EPS 10 Earth's Greatest Volcanic Eruptions 3 Units
Terms offered: Prior to 2007
A science-based course on the most significant eruptions Earth has produced. Most eruptions discussed will be from within historic time and will involve information from geology (volcanology), geography, archaeology, history, art, and paleoenvironmental records such as tree-rings and ice-cores. After a two-class introduction to volcanoes, volcanic activity, and volcanology, and the hazards vs benefits of eruptions, each class will feature one of more eruptions of different types from around the world. A science-based interpretation of the eruptions and effects on human-kind and the environment, will be presented. Class participants will learn about one type of natural hazard, its causes, and the variability of volcanism on Earth.
Earth's Greatest Volcanic Eruptions: Read More [+]

Hours & Format

Summer: 6 weeks - 8 hours of lecture per week

Additional Details

Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Self, Manga

Earth's Greatest Volcanic Eruptions: Read Less [-]

EPS C12 The Planets 3 Units
Terms offered: Spring 2021, Spring 2020, Spring 2019
A tour of the mysteries and inner workings of our solar system. What are planets made of? Why do they orbit the sun the way they do? How do planets form, and what are they made of? Why do some bizarre moons have oceans, volcanoes, and ice floes? What makes the Earth hospitable for life? Is the Earth a common type of planet or some cosmic quirk? This course will introduce basic physics, chemistry, and math to understand planets, moons, rings, comets, asteroids, atmospheres, and oceans. Understanding other worlds will help us save our own planet and help us understand our place in the universe.
The Planets: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week
Summer: 6 weeks - 7.5 hours of lecture and 2.5 hours of discussion per week

Additional Details

Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Also listed as: ASTRON C12/L & S C70T

The Planets: Read Less [-]
EPS W12 The Planets 3 Units
Terms offered: Summer 2021 8 Week Session, Summer 2020 8 Week Session, Summer 2019 8 Week Session
A tour of the mysteries and inner workings of our solar system. What are planets made of? Why do they orbit the sun the way they do? How do planets form, and what are they made of? Why do some bizarre moons have oceans, volcanoes, and ice floes? What makes the Earth hospitable for life? Is the Earth a common type of planet or some cosmic quirk? This course will introduce basic physics, chemistry, and math to understand planets, moons, rings, comets, asteroids, atmospheres, and oceans. Understanding other worlds will help us save our own planet and help us understand our place in the universe. This course is web-based.
The Planets: Read More [+]  
Hours & Format  
Summer: 8 weeks - 6 hours of web-based lecture per week  
Online: This is an online course.  
Additional Details  
Subject/Course Level: Earth and Planetary Science/Undergraduate  
Grading/Final exam status: Letter grade. Final exam required.  
Instructor: Militzer  
Formerly known as: Astronomy W12/Earth and Planetary Science W12  
Also listed as: ASTRON W12  
The Planets: Read Less [-]  

EPS 20 Earthquakes in Your Backyard 3 Units  
Terms offered: Summer 2021 First 6 Week Session, Summer 2021 Second 6 Week Session, Summer 2020 Second 6 Week Session  
Introduction to earthquakes, their causes and effects. General discussion of basic principles and methods of seismology and geological tectonics, distribution of earthquakes in space and time, effects of earthquakes, and earthquake hazard and risk, with particular emphasis on the situation in California.  
Earthquakes in Your Backyard: Read More [+]  
Hours & Format  
Fall and/or spring: 15 weeks - 2 hours of lecture per week  
Summer: 6 weeks - 5 hours of lecture per week  
Additional Details  
Subject/Course Level: Earth and Planetary Science/Undergraduate  
Grading/Final exam status: Letter grade. Final exam required.  
Also listed as: L & S C70Y  
Earthquakes in Your Backyard: Read Less [-]  

EPS C20 Earthquakes in Your Backyard 3 Units  
Terms offered: Fall 2021, Spring 2021, Fall 2020  
Introduction to earthquakes, their causes and effects. General discussion of basic principles and methods of seismology and geological tectonics, distribution of earthquakes in space and time, effects of earthquakes, and earthquake hazard and risk, with particular emphasis on the situation in California.  
Earthquakes in Your Backyard: Read More [+]  
Hours & Format  
Fall and/or spring: 15 weeks - 3 hours of lecture per week  
Summer: 6 weeks - 7.5 hours of lecture per week  
Additional Details  
Subject/Course Level: Earth and Planetary Science/Undergraduate  
Grading/Final exam status: Letter grade. Final exam required.  
Also listed as: L & S C70Y  
Earthquakes in Your Backyard: Read Less [-]  

EPS 24 Freshman Seminar in Earth and Planetary Sciences 1 Unit  
Terms offered: Fall 2021, Fall 2020, Fall 19  
The freshman seminar in earth and planetary science is designed to provide new students with an opportunity to explore a topic in geology or earth sciences with a faculty member in a small seminar setting. Topics will vary from semester to semester but will include such possible topics as great voyages of geologic discovery and the role of atmospheric sciences in geologic study.  
Freshman Seminar in Earth and Planetary Sciences: Read More [+]  
Rules & Requirements  
Repeat rules: Course may be repeated for credit when topic changes.  
Hours & Format  
Fall and/or spring: 15 weeks - 1 hour of seminar per week  
Additional Details  
Subject/Course Level: Earth and Planetary Science/Undergraduate  
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final Exam To be decided by the instructor when the class is offered.  
Formerly known as: Geology 24  
Freshman Seminar in Earth and Planetary Sciences: Read Less [-]
EPS 39 Freshman/Sophomore Seminar 2
Units
Terms offered: Fall 2019, Spring 2019
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester.
Freshman/Sophomore Seminar: Read More [+]

Rules & Requirements
Prerequisites: Priority given to freshmen and sophomores
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final Exam To be decided by the instructor when the class is offered.
Formerly known as: Geology 39
Freshman/Sophomore Seminar: Read Less [-]

EPS 39A Freshman/Sophomore Seminar 2 - 4
Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester.
Freshman/Sophomore Seminar: Read More [+]

Rules & Requirements
Prerequisites: Priority given to freshmen and sophomores
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 2-4 hours of seminar per week
Summer: 6 weeks - 5-10 hours of seminar per week

Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.
Formerly known as: Geology 39
Freshman/Sophomore Seminar: Read Less [-]

EPS 50 The Planet Earth 4 Units
Terms offered: Fall 2021, Spring 2021, Fall 2020
An introduction to the physical and chemical processes that have shaped the earth through time, with emphasis on the theory of plate tectonics. Laboratory work will involve the practical study of minerals, rocks, and geologic maps and exercises on geological processes.
The Planet Earth: Read More [+]

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week
Summer: 8 weeks - 7.5 hours of lecture and 7.5 hours of laboratory per week

Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Formerly known as: Geology 50
The Planet Earth: Read Less [-]

EPS 80 Environmental Earth Sciences 3 Units
Terms offered: Summer 2021 Second 6 Week Session, Summer 2020 Second 6 Week Session, Fall 2019
This course focuses on the processes on and in the earth that shape the environment. Humanity's use of land and oceans is examined based on an understanding of these processes.
Environmental Earth Sciences: Read More [+]

Rules & Requirements
Credit Restrictions: Students will receive no credit for 80 after taking Integrative Biology 80 or Paleontology 15.

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Summer: 6 weeks - 7.5 hours of lecture per week

Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Environmental Earth Sciences: Read Less [-]
**EPS 81 Atmospheres 3 Units**
Terms offered: Spring 2020, Spring 2019
An introductory survey of the atmospheres of Earth and other planets, spanning diverse phenomena such as hurricanes, drought, Martian dust storms, and the exotic winds on planets orbiting other stars. This course introduces the basics of planetary weather and climate, showing through exploration of a diverse set of atmospheres and paleoclimates that the world around us need not always be the way we currently observe it. Topics include atmospheric composition and structure, planetary orbits and radiation, habitability, global patterns of wind, clouds and precipitation, prediction of weather, chaos theory, and vortices such as tropical cyclones, tornadoes, and Jupiter’s great red spot.
Atmospheres: Read More [+]

**Hours & Format**
Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

**Additional Details**
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Boos
Atmospheres: Read Less [-]

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**EPS 82 Oceans 3 Units**
Terms offered: Fall 2021, Fall 2020
This course offers multidisciplinary approach to begin answering the question "Why are oceans important to us?" Upon a physical, chemical, and geologic base, we introduce the alien world of sea life, the importance of the ocean to the global carbon cycle, and the principles of ecology with a focus on the important concept of energy flow through food webs. Lectures expand beyond science to include current topics as diverse as music, movies, mythology, biomechanics, policy, and trade.
Oceans: Read More [+]

**Rules & Requirements**
Credit Restrictions: Students will receive no credit for EPS 82 after completing EPS N82.

**Hours & Format**
Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week
Summer:
6 weeks - 7.5 hours of lecture per week
8 weeks - 5.5 hours of lecture per week

**Additional Details**
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Instructors: Bishop, Edwards
Formerly known as: Earth and Planetary Science C82/Integrative Biology C82
Oceans: Read Less [-]
**EPS 88 PyEarth: A Python Introduction to Earth Science 2 Units**

Terms offered: Fall 2021, Fall 2020, Fall 2019

Earthquakes and El Ninos are examples of natural hazards in California. The course uses Python/Jupyter Notebook and real-world observations to introduce students to these and other Earth phenomena and their underlying physics. The students will learn how to access and visualize the data, extract signals, and make probability forecasts. The final module is a project that synthesizes the course material to make a probabilistic forecast. The course will be co-taught by a team of EPS faculty, and the focus of each semester will depend on the expertise of the faculty in charge.

PyEarth: A Python Introduction to Earth Science: Read More [+]

**Hours & Format**

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

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

**Instructors:** Fung, Boos, Dreger

PyEarth: A Python Introduction to Earth Science: Read Less [-]

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**EPS 100A Minerals: Their Constitution and Origin 4 Units**

Terms offered: Fall 2021, Fall 2020, Fall 2019

Introduction to structural, compositional, and physical properties of minerals, their analogs and related substances, their genesis in various geological and synthetic processes, and laboratory techniques to identify and investigate minerals. One field trip to selected mineral deposits and visits to laboratories.

Minerals: Their Constitution and Origin: Read More [+]

**Rules & Requirements**

**Prerequisites:** Some background in chemistry and physics

**Hours & Format**

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

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 100A

Minerals: Their Constitution and Origin: Read Less [-]

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**EPS 100B Genesis and Interpretation of Rocks 4 Units**

Terms offered: Spring 2021, Spring 2020, Spring 2019

Introduction to the principal geologic environments where rocks are formed and displayed. Igneous, sedimentary, and metamorphic processes discussed in the context of global tectonics.

Genesis and Interpretation of Rocks: Read More [+]

**Rules & Requirements**

**Prerequisites:** 100A

**Hours & Format**

Fall and/or spring: 15 weeks - 2 hours of lecture and 4 hours of laboratory per week

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 100B

Genesis and Interpretation of Rocks: Read Less [-]
**EPS C100 Communicating Ocean Science**

| Units | 4 |

For undergraduates 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.

**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 - 3 hours of lecture and 2 hours of fieldwork per week

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Rhew

**Formerly known as:** Earth and Planetary Science C100/Geography C146/Integrative Biology C100

**Also listed as:** GEOG C146/INTEGBI C100


**EPS 101 Field Geology and Digital Mapping**

| Units | 4 |
| Terms offered: | Fall 2021, Fall 2020, Spring 2019 |

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 Coast Ranges and California as a whole through field trips to key localities. Training in digital field mapping, global positioning systems, and laser surveying. Interdisciplinary focus encourages participation by nonmajors.

**Rules & Requirements**

**Prerequisites:** 50 or equivalent introductory course in Earth and Planetary Science

**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/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Instructor:** Rhew

**Formerly known as:** Geology 101

Field Geology and Digital Mapping: Read Less [-]


**EPS 102 History and Evolution of Planet Earth**

| Units | 4 |
| Terms offered: | Fall 2021, Fall 2020, Fall 2019 |

Formation and evolution of the earth. Nucleosynthesis; formation of the solar system; planetary accretion; dating the earth and solar system; formation of the core, mantle, oceans, and atmosphere; plate tectonics; heat transfer and internal dynamics; stratigraphic record of environment, and evolution; climate history and climate change.

**Rules & Requirements**

**Prerequisites:** 50

**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/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

History and Evolution of Planet Earth: Read Less [-]
EPS 103 Introduction to Aquatic and Marine Geochemistry 4 Units
Terms offered: Spring 2021, Spring 2019, Spring 2018
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.

EPS 104 Mathematical Methods in Geophysics 4 Units
Terms offered: Spring 2019, Spring 2017, Spring 2015
Linear systems. Linear inverse problems, least squares; generalized inverse, resolution; Fourier series, integral transforms; time series analysis, spherical harmonics; partial differential equations of geophysics; functions of a complex variable; probability and significance tests, maximum likelihood methods. Intended for students in geophysics and other physical sciences.

EPS 108 Geodynamics 4 Units
Terms offered: Spring 2021, Spring 2019, Fall 2016
Basic principles in studying the physical properties of earth materials and the dynamic processes of the earth. Examples are drawn from tectonics, mechanics of earthquakes, etc., to augment course material.

EPS 109 Computer Simulations with Jupyter Notebooks 4 Units
Terms offered: Fall 2021, Fall 2020, Fall 2019
Introduction to modern computer simulation methods and their application to selected Earth and Planetary Science problems. In hands-on computer labs, students will learn about numerical algorithms, learn to program and modify provided programs, and display the solution graphically. This is an introductory course and no programming experience is required. Examples include fractals in geophysics, properties of materials at high pressure, celestial mechanics, and diffusion processes in the Earth. Topics range from ordinary and partial differential equations to molecular dynamics and Monte Carlo simulations.

**EPS 113 Biological Oceanography and Biogeochemistry 4 Units**
Terms offered: Spring 2020
We will survey the biological oceanography underlying geochemical transformations in the sea. Students will develop a strong understanding of evolution, the central dogma of molecular biology, cell structure across the domains of life, population ecology, the metabolic strategies employed by marine organisms, and the biomarkers of life in the ocean. These biological concepts will be the foundation for understanding geochemical shifts as the earth was oxygenated, changes in inorganic nutrient pools with depth and location, nitrogen cycling, Southern Ocean silica leakage, the cryptic sulfur cycle, redox chemistry leveraged by organisms at hydrothermal vents, and the biological carbon pump.

**EPS 116 Structural Geology and Tectonics 3 Units**
Terms offered: Fall 2020, Spring 2019, Spring 2018
Introduction to the geometry and mechanics of brittle and ductile geologic structures; their origins and genetic relation to stress fields and their use as kinematic indicators; case histories of selected regions to elucidate tectonic evolution in different plate tectonic settings. Laboratory exercises will focus on analysis of hand specimens and structural relations portrayed on geologic maps. Several trips to observe geologic structures in the field to supplement laboratory exercises.

**EPS 115 Stratigraphy and Earth History 4 Units**
Terms offered: Spring 2020, Spring 2018, Spring 2016
Collecting, analyzing, and presenting stratigraphic data; dating and correlating sedimentary rocks; recognizing ancient environments and reconstructing Earth history; seismic and sequence stratigraphy; event stratigraphy and neocatastrophism; applications of stratigraphy to climate change, petroleum geology, and archaeology.

**EPS 117 Geomorphology 4 Units**
Terms offered: Fall 2021, Fall 2019, Fall 2018
Quantitative examination of landforms, runoff generation, weathering, mechanics of soil erosion by water and wind, mass wasting, glacial and periglacial processes and hillslope evolution.
**EPS 118 Advanced Field Course 4 Units**
Terms offered: Spring 2021, Spring 2020, Spring 2018
Advanced geological mapping, intensive field observation, and problem solving in the field areas selected by instructors. Includes preparation of final reports.
Advanced Field Course: Read More [+]

**Rules & Requirements**

**Prerequisites:** 50, 100A-100B, 101, or consent of instructor; 119 is strongly recommended

**Hours & Format**

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

**Summer:** 6 weeks - 7.5 hours of lecture and 5 hours of discussion per week

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Final exam not required.

**Instructor:** Brimhall

**Formerly known as:** Geology 118

Advanced Field Course: Read Less [-]

**EPS 119 Geologic Field Studies 2 Units**
Terms offered: Fall 2021, Spring 2019, Spring 2018
Two to four weekend field trips to localities of geological interest.
Geologic Field Studies: Read More [+]

**Rules & Requirements**

**Prerequisites:** 101 and consent of instructor

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

**Hours & Format**

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

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Final exam not required.

**Formerly known as:** Geology 119

Geologic Field Studies: Read Less [-]

**EPS 122 Physics of the Earth and Planetary Interiors 3 Units**
Terms offered: Spring 2020, Spring 2018, Spring 2017
Gravity field, density distribution, and internal seismic structure of the Earth and planets. Constitution, composition, temperature distribution, and energetics of the Earth's interior. The geomagnetic field and the geodynamo, and concepts in seismic imaging and geophysical fluid dynamics. This course welcomes physics, computer science, engineering and applied maths majors.
Physics of the Earth and Planetary Interiors: Read More [+]

**Rules & Requirements**

**Prerequisites:** Physics 7A-B, Mathematics 53-54, or equivalent

**Hours & Format**

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

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Alternative to final exam.

Physics of the Earth and Planetary Interiors: Read Less [-]

**EPS 124 Isotopic Geochemistry 4 Units**
Terms offered: Spring 2021, Spring 2019, Spring 2017
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/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** David Shuster

Isotopic Geochemistry: Read Less [-]
EPS 125 Stable Isotope Geochemistry 4 Units
Terms offered: Spring 2020, Spring 2018
This course provides an introduction to the principles of stable isotope geochemistry and the application of these principles to problems in Earth and planetary science. This course provides a foundation for the physical, chemical, and biological processes that cause isotopes to fractionate in nature including the kinetic theory of gases, equilibrium thermodynamics, and the kinetics of chemical reactions. These principles will be applied to the study of problems related to the water cycle, paleoclimate, igneous petrology, biogeochemical cycles in the past and present, and planetary science.

Stable Isotope Geochemistry: 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/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Stolper

Stable Isotope Geochemistry: Read Less [-]

EPS 129 Biometeorology 3 Units
Terms offered: Fall 2020, Fall 2018, Fall 2016
This course describes how the physical environment (light, wind, temperature, humidity) of plants and soil affects the physiological status of plants and how plants affect their physical environment. Using experimental data and theory, it examines physical, biological, and chemical processes affecting transfer of momentum, energy, and material (water, CO2, atmospheric trace gases) between vegetation and the atmosphere. Plant biometeorology instrumentation and measurements are also discussed.

Biometeorology: Read More [+]

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Baldocchi
Also listed as: ESPM C129

Biometeorology: Read Less [-]

EPS 130 Strong Motion Seismology 3 Units
Terms offered: Spring 2021, Spring 2020, Spring 2019

Strong Motion Seismology: Read More [+]

Rules & Requirements
Prerequisites: Mathematics 54, or equivalent and 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/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Formerly known as: Geophysics 130

Strong Motion Seismology: Read Less [-]

EPS 131 Geochemistry 4 Units
Terms offered: Fall 2020, Fall 2019, Fall 2018

Geochemistry: Read More [+]

Rules & Requirements
Prerequisites: 100A-100B, Chemistry 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/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: David Shuster

Geochemistry: Read Less [-]
EPS 150 Case Studies in Earth Systems 2 Units
Terms offered: Fall 2021, Spring 2021, Fall 2020
Analysis and discussion of three research problems on the interactions of solid earth, hydrologic, chemical, and atmospheric processes. Emphasis is on the synthesis and application of the student's disciplinary knowledge to a new integrative problem in the earth sciences.
Case Studies in Earth Systems: Read More [+]
Rules & Requirements
Prerequisites: 50, senior standing or consent of instructor
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture per week
Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Case Studies in Earth Systems: Read Less [-]
EPS C162 Planetary Astrophysics 4 Units
Terms offered: Fall 2020, Fall 2019, Fall 2018
Physics of planetary systems, both solar and extra-solar. Star and planet formation, radioactive dating, small-body dynamics and interaction of radiation with matter, tides, planetary interiors, atmospheres, and magnetospheres. High-quality oral presentations may be required in addition to problem sets and a final exam.
Planetary Astrophysics: Read More [+]
Rules & Requirements
Prerequisites: Mathematics 53, 54; Physics 7A-7B-7C
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Alternative to final exam.
Instructors: Chiang, de Pater, Marcy
Also listed as: ASTRON C162
Planetary Astrophysics: Read Less [-]
EPS C178 Applied Geophysics 3 Units
Terms offered: Fall 2021, Fall 2020, Fall 2019, Fall 2018
The theory and practice of geophysical methods for determining the subsurface distribution of physical rock and soil properties. Measurements of gravity and magnetic fields, electrical and electromagnetic fields, and seismic velocity are interpreted to map the subsurface distribution of density, magnetic susceptibility, electrical conductivity, and mechanical properties.
Applied Geophysics: Read More [+]
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture per week
Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Rector
Also listed as: CIV ENG C178
Applied Geophysics: Read Less [-]
EPS C180 Air Pollution 3 Units
Terms offered: Spring 2021, Spring 2020, Spring 2018
This course is an introduction to air pollution and the chemistry of earth's atmosphere. We will focus on the fundamental natural processes controlling trace gas and aerosol concentrations in the atmosphere, and how anthropogenic activity has affected those processes at the local, regional, and global scales. Specific topics include stratospheric ozone depletion, increasing concentrations of greenhouse gases, smog, and changes in the oxidation capacity of the troposphere.
Air Pollution: Read More [+]
Rules & Requirements
Prerequisites: CHEM 1A, CHEM 1B, and PHYSICS 8A or consent of instructor
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/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Goldstein
Also listed as: CIV ENG C106/ESPM C180
Air Pollution: Read Less [-]
EPS C181 Atmospheric Physics and Dynamics 3 Units
Terms offered: Fall 2020, Fall 2019, Fall 2018
This course examines the processes that determine the structure and circulation of the Earth’s atmosphere. The approach is deductive rather than descriptive: to figure out the properties and behavior of the Earth’s atmosphere based on the laws of physics and fluid dynamics. Topics will include interaction between radiation and atmospheric composition; the role of water in the energy and radiation balance; governing equations for atmospheric motion, mass conservation, and thermodynamic energy balance; geostrophic flow, quasigeostrophic motion, baroclinic instability and dynamics of extratropical cyclones.

Rules & Requirements
Prerequisites: Mathematics 53, 54; Physics 7A-7B-7C
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Chiang, Fung
Also listed as: GEOG C139
Atmospheric Physics and Dynamics: Read Less [-]

EPS C182 Atmospheric Chemistry and Physics Laboratory 3 Units
Terms offered: Spring 2021, Spring 2020, Spring 2019
Fluid dynamics, radiative transfer, and the kinetics, spectroscopy, and measurement of atmospherically relevant species are explored through laboratory experiments, numerical simulations, and field observations.

Rules & Requirements
Prerequisites: Earth and Planetary Science 50 and 102 with grades of C- or higher (one of which may be taken concurrently) or two of the following: Chemistry 120A, 120B, C130, or 130B with grades of C- or higher (one of which may be taken concurrently)
Credit Restrictions: Deficiency in C182 may be removed by successfully completing 125. Consent of instructor is required to enroll in C182 after completing 125.

Hours & Format
Fall and/or spring: 15 weeks - 1.5 hours of lecture and 5 hours of laboratory per week
Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Formerly known as: Chemistry C182/Earth and Planetary Science C182
Also listed as: CHEM C182
Atmospheric Chemistry and Physics Laboratory: Read Less [-]

EPS C183 Carbon Cycle Dynamics 3 Units
Terms offered: Fall 2021, Spring 2019, Spring 2016
The focus is the (unsolved) puzzle of the contemporary carbon cycle. Why is the concentration of atmospheric CO2 changing at the rate observed? What are the terrestrial and oceanic processes that add and remove carbon from the atmosphere? What are the carbon management strategies under discussion? How can emission protocols be verified? Students are encouraged to gain hands-on experience with the available data, and learn modeling skills to evaluate hypotheses of carbon sources and sinks.

Rules & Requirements
Prerequisites: Mathematics 53, 54; Physics 7A-7B-7C
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Earth and Planetary Science/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Instructor: Fung
Also listed as: ESPM C170
Carbon Cycle Dynamics: Read Less [-]
**EPS H195 Senior Honors Course 3 Units**  
Terms offered: Fall 2014, Spring 2013, Fall 2012  
Original research and preparation of an acceptable thesis. May be taken during two consecutive semesters of senior year and may be substituted for six units of the upper division requirement with consent of major adviser.  
Senior Honors Course: Read More [+]

**Rules & Requirements**

**Prerequisites:** Limited to honors candidates  
**Repeat rules:** Course may be repeated for credit up to a total of 6 units.

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate  
**Grading/Final exam status:** Letter grade. Final exam not required.

**EPS 197 Field Study 1 - 4 Units**  
Terms offered: Fall 2010  
Written proposal signed by faculty sponsor and approved by major faculty advisor. Supervised experience relevant to specific aspects of students’ EPS specialization in off-campus organization. Regular meetings with faculty sponsor and written report required.  
Field Study: Read More [+]

**Rules & Requirements**

**Prerequisites:** Upper division standing and declared major in Earth and Planetary Science  
**Credit Restrictions:** Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.  
**Repeat rules:** Course may be repeated for credit without restriction.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3-12 hours of fieldwork per week  
**Summer:**  
6 weeks - 7.5-30 hours of fieldwork per week  
8 weeks - 6-24 hours of fieldwork per week  
10 weeks - 4.5-18 hours of fieldwork per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate  
**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Formerly known as:** Geology 198

**Directed Group Study:** Read Less [-]

**EPS 198 Directed Group Study 1 - 4 Units**  
Terms offered: Spring 2021, Fall 2020, Spring 2015  
Group studies of selected topics which vary from semester to semester.  
Directed Group Study: Read More [+]

**Rules & Requirements**

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

**Hours & Format**

**Fall and/or spring:** 15 weeks - 1-4 hours of directed group study per week  
**Summer:**  
6 weeks - 7.5-30 hours of directed group study per week  
8 weeks - 6-24 hours of directed group study per week  
10 weeks - 4.5-18 hours of directed group study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate  
**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Formerly known as:** Geology 198

**Directed Group Study:** Read Less [-]

**EPS 199 Supervised Independent Study and Research 1 - 4 Units**  
Terms offered: Fall 2020, Fall 2015, Spring 2015  
Enrollment is restricted by regulations.  
Supervised Independent Study and Research: Read More [+]

**Rules & Requirements**

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

**Hours & Format**

**Fall and/or spring:** 15 weeks - 1-4 hours of independent study per week  
**Summer:**  
6 weeks - 2.5-10 hours of independent study per week  
8 weeks - 1.5-7.5 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate  
**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Formerly known as:** Geology 199

**Supervised Independent Study and Research:** Read Less [-]