Physics

Overview

Physics at UC Berkeley has long been at the forefront of discovery and achievement. In 1931, Ernest O. Lawrence invented the cyclotron at Berkeley, ushering in the era of high-energy physics and a tradition of achievement that continues today. Nine of Berkeley's 22 Nobel Prizes were awarded to Berkeley physicists. The most recent National Research Council nationwide rankings identify the department as one of the best in the nation.

In the last 50 years, Berkeley physicists have made many of the significant discoveries that support today's science. These discoveries extend from fundamental properties of elementary particles to spin echoes—the basis of magnetic resonance imaging to cutting-edge breakthroughs for building an accurate model of how the universe took shape following the monster explosion commonly known as the Big Bang. Today, faculty members are leading the way in scientific research and discovery in ways that may challenge the fundamental laws of physics particularly in the areas of gravitation, matter, and energy. At the same time, undergraduate and graduate teaching—through formal courses and research activity — is an integral part of the faculty's commitment to the development of tomorrow's scientists.

In their pursuit of original research, physics faculty members collaborate with postdoctoral fellows, Ph.D. graduate students, undergraduate students, and visiting scholars. Research opportunities include a wide range of topics in theoretical and experimental physics, astrophysics, atomic physics, molecular physics, biophysics, condensed matter, cosmic rays, elementary particles and fields, energy and resources, fusion and plasma, geochronology, general relativity, low-temperature physics, mathematical physics, nuclear physics, optical and laser spectroscopy, space physics, and statistical mechanics.

Undergraduate Programs

Physics (http://guide.berkeley.edu/archive/2019-20/undergraduate/degree-programs/physics): BA, Minor

Graduate Program

Physics (http://guide.berkeley.edu/archive/2019-20/graduate/degree-programs/physics): MA, PhD

Physics

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

PHYSICS 5A Introductory Mechanics and Relativity 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Kinematics, dynamics, work and energy, rotational motion, oscillations, fluids and relativity. Use of calculus and vector algebra will be emphasized. Intended for students with an interest in pursuing a major in physics, astrophysics, engineering physics, or related disciplines. Successor to the Physics H7 series. Start of three semester 5A-5B-5C sequence.
Introductory Mechanics and Relativity: Read More [+]
Rules & Requirements

Prerequisites: Prerequisites: Math 1A; Math 1B (which may be taken concurrently)

Repeat rules: Course may be repeated for credit under special circumstances: Only repeatable to replace deficient grade.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introductory Mechanics and Relativity: Read Less [-]

PHYSICS 5B Introductory Electromagnetism, Waves, and Optics 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Electric fields and potential, circuits, magnetism and induction. Introduction to optics including light propagation, reflection, refraction and interference. Intended for students with an interest in pursuing a major in physics, astrophysics, engineering physics, or related disciplines. Successor to the Physics H7 series. Continuation of 5A-5B-5C sequence.
Introductory Electromagnetism, Waves, and Optics: Read More [+]
Rules & Requirements

Prerequisites: Prerequisites: Physics 5A or 7A; Math 53 (which may be taken concurrently)

Repeat rules: Course may be repeated for credit under special circumstances: Only repeatable to replace deficient grade.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introductory Electromagnetism, Waves, and Optics: Read Less [-]

PHYSICS 5BL Introduction to Experimental Physics I 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Part one of a two-semester laboratory sequence to introduce students to experimental physics and prepare them for research. Covers a variety of modern and historical experiments, emphasizing data analysis, clear scientific communication, and development of skills on modern equipment. Successor to the Physics H7 series.
Introduction to Experimental Physics I: Read More [+]

Rules & Requirements

Prerequisites: Prerequisites: Physics 5A or 7A; 5B or 7B (which may be taken concurrently)

Repeat rules: Course may be repeated for credit under special circumstances: Only repeatable to replace deficient grade.

Hours & Format

Fall and/or spring: 15 weeks - 5 hours of laboratory per week

Summer: 6 weeks - 12.5 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introduction to Experimental Physics I: Read Less [-]

PHYSICS 5C Introductory Thermodynamics and Quantum Mechanics 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Temperature, kinetic theory, entropy; particle/wave nature of matter, Schrodinger equation, hydrogen atom, applications of quantum physics. Intended for students with an interest in pursuing a major in physics, astrophysics, engineering physics or related disciplines. Continuation of 5A-5B-5C sequence. Successor to the Physics H7 series.
Introductory Thermodynamics and Quantum Mechanics: Read More [+]

Rules & Requirements

Prerequisites: Prerequisites: Physics 5B or 7B; Physics 89 or Math 54 (which may be taken concurrently)

Repeat rules: Course may be repeated for credit under special circumstances: Only repeatable to replace deficient grade.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introductory Thermodynamics and Quantum Mechanics: Read Less [-]

PHYSICS 5CL Introduction to Experimental Physics II 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Part two of a two-semester laboratory sequence to introduce students to experimental physics and prepare them for research. Covers a variety of modern and historical experiments, emphasizing iterative experimental design, clear scientific communication, and development of skills on modern equipment. Successor to the Physics H7 series.
Introduction to Experimental Physics II: Read More [+]

Rules & Requirements

Prerequisites: Physics 5B & 5BL or 7B; Physics 5C or 7C (which may be taken concurrently)

Repeat rules: Course may be repeated for credit under special circumstances: Only repeatable to replace deficient grade.

Hours & Format

Fall and/or spring: 15 weeks - 5 hours of laboratory per week

Summer: 6 weeks - 12.5 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introduction to Experimental Physics II: Read Less [-]

PHYSICS 7A Physics for Scientists and Engineers 4 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020
Mechanics and wave motion.
Physics for Scientists and Engineers: Read More [+]

Rules & Requirements

Prerequisites: High school physics; Math 1A; Math 1B (which may be taken concurrently)

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture, 4 hours of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Physics for Scientists and Engineers: Read Less [-]

PHYSICS 7B Physics for Scientists and Engineers 4 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020
Heat, electricity, and magnetism.
Physics for Scientists and Engineers: Read More [+]
Rules & Requirements

Prerequisites: 7A, Math 1A-1B, Math 53 (may be taken concurrently)

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture, 4 hours of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Physics for Scientists and Engineers: Read Less [-]

PHYSICS 7C Physics for Scientists and Engineers 4 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020
Electromagnetic waves, optics, relativity, and quantum physics.
Physics for Scientists and Engineers: Read More [+]
Rules & Requirements

Prerequisites: 7A-7B, Math 1A-1B, Math 53, 54 (Math 54 may be taken concurrently)

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Physics for Scientists and Engineers: Read Less [-]

PHYSICS H7A Physics for Scientists and Engineers 4 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
Honors sequence corresponding to 7A-7B-7C, but with a greater emphasis on theory as opposed to problem solving. Recommended for those students who have had advanced Physics on the high school level and who are intending to declare a major in physics. Entrance into H7A is decided on the basis of performance on an examination given during the first week of class or the consent of the instructor, and into H7B-H7C on performance in previous courses in a standard sequence.
Physics for Scientists and Engineers: Read More [+]
Rules & Requirements

Prerequisites: High school physics; Math 1A; Math 1B (may be taken concurrently)

Credit Restrictions: Students will received no credit for H7A after taking 7A.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Physics for Scientists and Engineers: Read Less [-]

PHYSICS H7B Physics for Scientists and Engineers 4 Units

Terms offered: Fall 2016, Spring 2016, Fall 2015
Honors sequence corresponding to 7A-7B-7C, but with a greater emphasis on theory as opposed to problem solving. Recommended for those students who have had advanced Physics on the high school level and who are intending to declare a major in physics. Entrance into H7A is decided on the basis of performance on an examination given during the first week of class or the consent of the instructor, and into H7B-H7C on performance in previous courses in a standard sequence.
Physics for Scientists and Engineers: Read More [+]
Rules & Requirements

Prerequisites: 7A, Math 1A-1B, Math 53 (may be taken concurrently)

Credit Restrictions: Students will receive no credit H7B after taking 7B.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Physics for Scientists and Engineers: Read Less [-]

PHYSICS H7C Physics for Scientists and Engineers 4 Units

Terms offered: Fall 2016, Spring 2016, Fall 2015
Honors sequence corresponding to 7A-7B-7C, but with a greater emphasis on theory as opposed to problem solving. Recommended for those students who have had advanced Physics on the high school level and who are intending to declare a major in physics. Entrance into H7A is decided on the basis of performance on an examination given during the first week of class or the consent of the instructor, and into H7B-H7C on performance in previous courses in a standard sequence.
Physics for Scientists and Engineers: Read More [+]
Rules & Requirements

Prerequisites: 7A-7B, Math 1A-1B, Math 53, 54 (Math 54 may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Physics for Scientists and Engineers: Read Less [-]

PHYSICS 8A Introductory Physics 4 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020
Introduction to forces, kinetics, equilibria, fluids, waves, and heat. This course presents concepts and methodologies for understanding physical phenomena, and is particularly useful preparation for upper division study in biology and architecture.
Introductory Physics: Read More [+]
Rules & Requirements

Prerequisites: Mathematics 1A, 10A, 16A, or equivalent, or consent of instructor

Credit Restrictions: Students with credit for 7A will not receive credit for 8A.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture, 4 hours of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introductory Physics: Read Less [-]

PHYSICS 8B Introductory Physics 4 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020
Introduction to electricity, magnetism, electromagnetic waves, optics, and modern physics. The course presents concepts and methodologies for understanding physical phenomena, and is particularly useful preparation for upper division study in biology and architecture.
Introductory Physics: Read More [+]
Rules & Requirements

Prerequisites: 8A or equivalent

Credit Restrictions: Students with credit for 7B or 7C will not receive credit for Physics 8B.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture, 4 hours of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introductory Physics: Read Less [-]

PHYSICS 10 Descriptive Introduction to Physics 3 Units

Terms offered: Fall 2018, Fall 2017, Spring 2005
The most interesting and important topics in physics, stressing conceptual understanding rather than math, with applications to current events. Topics covered may vary and may include energy and conservation, radioactivity, nuclear physics, the Theory of Relativity, lasers, explosions, earthquakes, superconductors, and quantum physics.
Descriptive Introduction to Physics: Read More [+]
Rules & Requirements

Prerequisites: Open to students with or without high school physics

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Descriptive Introduction to Physics: Read Less [-]

PHYSICS C10 Descriptive Introduction to Physics 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
The most interesting and important topics in physics, stressing conceptual understanding rather than math, with applications to current events. Topics covered may vary and may include energy and conservation, radioactivity, nuclear physics, the Theory of Relativity, lasers, explosions, earthquakes, superconductors, and quantum physics.
Descriptive Introduction to Physics: Read More [+]
Rules & Requirements

Prerequisites: Open to students with or without high school physics

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Also listed as: L & S C70V

Descriptive Introduction to Physics: Read Less [-]

PHYSICS 21 Physics of Music 3 Units

Terms offered: Spring 2003, Spring 2002, Spring 2000
Physical principles encountered in the study of music. The applicable laws of mechanics, fundamentals of sound, harmonic content, principles of sound production in musical instruments, musical scales. Numerous illustrative lecture demonstrations will be given. Only the basics of high school algebra and geometry will be used.
Physics of Music: Read More [+]
Rules & Requirements

Prerequisites: No previous courses in Physics are assumed, although Physics 10 is recommended

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Physics of Music: Read Less [-]

PHYSICS C21 Physics and Music 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
What can we learn about the nature of reality and the ways that we humans have invented to discover how the world works? An exploration of these questions through the physical principles encountered in the study of music. The applicable laws of mechanics, fundamentals of sound, harmonic content, principles of sound production in musical instruments, musical scales. Numerous illustrative lecture demonstrations will be given. Only the basics of high school algebra and geometry will be used.
Physics and Music: Read More [+]
Rules & Requirements

Prerequisites: No previous courses in Physics are assumed, although Physics 10 is recommended

Credit Restrictions: Students will receive no credit for Physics C21/ Letters and Science C70W after completing Physics 21. A deficient grade in Physics 21 may be removed by taking Physics C21/Letters and Science C70W.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Also listed as: L & S C70W

Physics and Music: Read Less [-]

PHYSICS 24 Freshman Seminars 1 Unit

Terms offered: Fall 2020, Fall 2019, Spring 2019
The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.
Freshman Seminars: 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: Physics/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman Seminars: Read Less [-]

PHYSICS 39 Lower Division Physics Seminar 1.5 - 4 Units

Terms offered: Spring 2010, Spring 2009, Fall 2008
Enrollment limited to 20 students per section. Physics seminar course designed for both non major students and students considering a major in physics. Topics vary from semester to semester.
Lower Division Physics Seminar: Read More [+]
Rules & Requirements

Prerequisites: Enrollment by consent of instructor during the week of pre-enrollment. Consult bulletin boards outside 366 Le Conte for more information

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

Hours & Format

Fall and/or spring: 15 weeks - 1.5-4 hours of seminar per week

Summer: 6 weeks - 3.5-10 hours of seminar per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Lower Division Physics Seminar: Read Less [-]

PHYSICS 49 Supplementary Work in Lower Division Physics 1 - 3 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017
Students with partial credit in lower division physics courses may, with consent of instructor, complete the credit under this heading.
Supplementary Work in Lower Division Physics: 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

Summer: 8 weeks - 1-3 hours of independent study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Supplementary Work in Lower Division Physics: Read Less [-]

PHYSICS 77 Introduction to Computational Techniques in Physics 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Introductory scientific programming in Python with examples from physics. Topics include: visualization, statistics and probability, regression, numerical integration, simulation, data modeling, function approximation, and algebraic systems. Recommended for freshman physics majors.
Introduction to Computational Techniques in Physics: Read More [+]
Rules & Requirements

Prerequisites: Math 1A; Physics 5A or 7A (which may be taken concurrently) or permission of instructor

Hours & Format

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

Summer: 10 weeks - 3 hours of lecture and 3 hours of workshop per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introduction to Computational Techniques in Physics: Read Less [-]

PHYSICS 88 Data Science Applications in Physics 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Introduction to data science with applications to physics. Topics include: statistics and probability in physics, modeling of the physical systems and data, numerical integration and differentiation, function approximation. Connector course for Data Science 8, room-shared with Physics 77. Recommended for freshmen intended to major in physics or engineering with emphasis on data science.
Data Science Applications in Physics: Read More [+]
Objectives & Outcomes

Student Learning Outcomes: Learning goals for Physics 88
The following learning goals will guide the presentation of material as well as development of HWs, rubrics for assessment, and practice problems for use in discussion section: 1) Use of representations, 2) Communication, 3) Tools, 4) Problem-Solving, 5) Making connections, 6) Intellectual maturity and metacognition, 7) Resourcefulness.

Rules & Requirements

Prerequisites: Math 1A, 1B (1B can be taken concurrently), Physics 5A or 7A (may be taken concurrently), Data Science 8 (may be taken concurrently), or permission of instructor

Hours & Format

Fall and/or spring: 9 weeks - 2 hours of lecture and 2 hours of workshop per week

Summer: 6 weeks - 3 hours of lecture and 3 hours of workshop per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Data Science Applications in Physics: Read Less [-]

PHYSICS 89 Introduction to Mathematical Physics 4 Units

Terms offered: Fall 2020, Summer 2020 10 Week Session, Spring 2020
Complex numbers, linear algebra, ordinary differential equations, Fourier series and transform methods, introduction to partial differential equations, introduction to tensors. Applications to physics will be emphasized. This course or an equivalent course required for physics major.
Introduction to Mathematical Physics: Read More [+]
Rules & Requirements

Prerequisites: Math 53; Physics 5A or 7A (can be taken concurrently) or instructor's consent

Hours & Format

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

Summer: 10 weeks - 4 hours of lecture and 3 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introduction to Mathematical Physics: Read Less [-]

PHYSICS 98 Directed Group Study 1 - 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Directed Group Study: Read More [+]
Rules & Requirements

Prerequisites: Restricted to freshman and sophomores only; consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Summer: 8 weeks - 1.5-7.5 hours of directed group study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study: Read Less [-]

PHYSICS 98BC Berkeley Connect 1 Unit

Terms offered: Fall 2020, Spring 2020, Fall 2019
Berkeley Connect is a mentoring program, offered through various academic departments, that helps students build intellectual community. Over the course of a semester, enrolled students participate in regular small-group discussions facilitated by a graduate student mentor (following a faculty-directed curriculum), meet with their graduate student mentor for one-on-one academic advising, attend lectures and panel discussions featuring department faculty and alumni, and go on field trips to campus resources. Students are not required to be declared majors in order to participate.
Berkeley Connect: 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 directed group study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Berkeley Connect: Read Less [-]

PHYSICS 99 Supervised Independent Study 1 - 3 Units

Terms offered: Spring 2017, Spring 2016, Fall 2015
Supervised Independent Study: Read More [+]
Rules & Requirements

Prerequisites: Restricted to freshmen and sophomores only; consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer: 8 weeks - 1.5-7.5 hours of independent study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study: Read Less [-]

PHYSICS 100 Communicating Physics and Physical Science 2 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008
For undergraduate and graduate students interested in improving their ability to communicate scientific knowledge by teaching science in K-12 schools. The course will combine instruction in inquiry-based science teaching methods and learning pedagogy with 10 weeks of supervised teaching experience in a local school. Students will practice, with support and mentoring, communicating scientific knowledge through presentations and hands-on activities. Approximately three hours per week including time spent in school classrooms.
Communicating Physics and Physical Science: Read More [+]
Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Communicating Physics and Physical Science: Read Less [-]

PHYSICS 105 Analytic Mechanics 4 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020
Newtonian mechanics, motion of a particle in one, two, and three dimensions, Lagrange's equations, Hamilton's equations, central force motion, moving coordinate systems, mechanics of continuous media, oscillations, normal modes, rigid body dynamics, tensor analysis techniques. Some knowledge of Python required for homework assignments. Students who have not taken Physics 77 or Data Science 8 are encouraged to complete the Python tutorials provided by the Physics Department.
Analytic Mechanics: Read More [+]
Rules & Requirements

Prerequisites: Physics 5A, 5B, 5C or 7A, 7B, 7C

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Analytic Mechanics: Read Less [-]

PHYSICS 110A Electromagnetism and Optics 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Part I. A course emphasizing electromagnetic theory and applications; charges and currents; electric and magnetic fields; dielectric, conducting, and magnetic media; relativity, Maxwell equations. Wave propagation in media, radiation and scattering, Fourier optics, interference and diffraction, ray optics and applications.
Electromagnetism and Optics: Read More [+]
Rules & Requirements

Prerequisites: Physics 5A, 5B, 5C or 7A, 7B, 7C

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Electromagnetism and Optics: Read Less [-]

PHYSICS 110B Electromagnetism and Optics 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Part II. A course emphasizing electromagnetic theory and applications; charges and currents; electric and magnetic fields; dielectric, conducting, and magnetic media; relativity, Maxwell equations. Wave propagation in media, radiation and scattering, Fourier optics, interference and diffraction, ray optics and applications.
Electromagnetism and Optics: Read More [+]
Rules & Requirements

Prerequisites: Physics 5A, 5B, 5C or 7A, 7B, 7C and 110A

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Electromagnetism and Optics: Read Less [-]

PHYSICS 111A Instrumentation Laboratory 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
The instrumentation lab (formerly Basic Semiconductor Circuits) is an introductory course in basic design, analysis and modeling of circuits, and data analysis and control. Topics include but not limited to:
linear circuits, semiconductor diodes, JFETS, Op-Amps, Labview programming, ADC and DAC converters, signal processing, and feedback control.
Instrumentation Laboratory: Read More [+]
Rules & Requirements

Prerequisites: Consent of Instructor

Hours & Format

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

Summer: 10 weeks - 12 hours of laboratory and 4.5 hours of lecture per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Instrumentation Laboratory: Read Less [-]

PHYSICS 111B Advanced Experimentation Laboratory 1 - 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
In the advanced experimentation lab students complete four of 20+ advanced experiments. These include many experiments in atomic, nuclear, particle physics, biophysics, and solid-state physics, among others.
Advanced Experimentation Laboratory: Read More [+]
Rules & Requirements

Prerequisites: Physics 111A and 137A or consent of instructor

Credit Restrictions: Three units of the Advanced Experimentation lab required for physics major; After the first three units, lab may be repeated for additional credit. No more than three units may be completed in one semester.

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

Hours & Format

Fall and/or spring: 15 weeks - 3-9 hours of laboratory per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Formerly known as: Physics 111

Advanced Experimentation Laboratory: Read Less [-]

PHYSICS 112 Introduction to Statistical and Thermal Physics 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Basic concepts of statistical mechanics, microscopic basis of thermodynamics and applications to macroscopic systems, condensed states, phase transformations, quantum distributions, elementary kinetic theory of transport processes, fluctuation phenomena. Some knowledge of Python required for homework assignments. Students who have not taken Physics 77 or Data Science 8 are encouraged to complete the Python tutorials provided by the Physics Department.
Introduction to Statistical and Thermal Physics: Read More [+]
Rules & Requirements

Prerequisites: Physics 5A, 5B, 5C or 7A, 7B, 7C

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introduction to Statistical and Thermal Physics: Read Less [-]

PHYSICS 129 Particle Physics 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Tools of particle and nuclear physics. Properties, classification, and interaction of particles including the quark-gluon constituents of hadrons. High energy phenomena analyzed by quantum mechanical methods. Course will survey the field including some related topics in nuclear physics. Some knowledge of Python required. Students who have not taken Physics 77 or Data Science 8 are encouraged to complete the Python tutorials provided by the Physics Department.
Particle Physics: Read More [+]
Rules & Requirements

Prerequisites: 137A, 137B (may be taken concurrently), 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: Physics/Undergraduate

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

Formerly known as: 129A

Particle Physics: Read Less [-]

PHYSICS 130 Quantum and Nonlinear Optics 3 Units

Terms offered: Spring 2020, Spring 2018, Spring 2016
Detailed theory and experimental basis of quantum and nonlinear optics, exhibiting concepts of quantum measurement, noise, stochastic processes and dissipative quantum systems. Topics include second-quantization of electromagnetic fields, photodetection, coherence properties, light-atom interactions, cavity quantum electrodynamics, nonlinear optical systems, squeezed light, aspects of quantum information science, and contemporary research.
Quantum and Nonlinear Optics: Read More [+]
Rules & Requirements

Prerequisites: 110A and 137A-137B, 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: Physics/Undergraduate

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

Quantum and Nonlinear Optics: Read Less [-]

PHYSICS 137A Quantum Mechanics 4 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020
Part I. Introduction to the methods of quantum mechanics with applications to atomic, molecular, solid state, nuclear and elementary particle physics.
Quantum Mechanics: Read More [+]
Rules & Requirements

Prerequisites: Physics 5A, 5B, 5C or 7A, 7B, 7C

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Quantum Mechanics: Read Less [-]

PHYSICS 137B Quantum Mechanics 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Part II. Introduction to the methods of quantum mechanics with applications to atomic, molecular, solid state, nuclear and elementary particle physics.
Quantum Mechanics: Read More [+]
Rules & Requirements

Prerequisites: Physics 7A, 7B, 7C and 137A

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Quantum Mechanics: Read Less [-]

PHYSICS 138 Modern Atomic Physics 3 Units

Terms offered: Spring 2019, Spring 2017, Spring 2015
This course covers atomic, molecular, and optical physics as a quantitative description of atoms and fields, a generalized toolbox for controlling quantum systems, and a vibrant research area. Topics covered include atomic structure and spectra, atom-field interactions, topics in quantum electrodynamics, methods of resonant manipulation of quantum systems, resonance optics, and experimental techniques.
Modern Atomic Physics: Read More [+]
Rules & Requirements

Prerequisites: 137A-137B

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Modern Atomic Physics: Read Less [-]

PHYSICS 139 Special Relativity and General Relativity 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Historical and experimental foundations of Einstein's special theory of relativity; spatial and temporal measurements, particle dynamics, electrodynamics, Lorentz invariants. Introduction to general relativity. Selected applications. Designed for advanced undergraduates in physics and astronomy.
Special Relativity and General Relativity: Read More [+]
Rules & Requirements

Prerequisites: 105, 110A 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: Physics/Undergraduate

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

Special Relativity and General Relativity: Read Less [-]

PHYSICS 141A Solid State Physics 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Part I. A thorough introductory course in modern solid state physics. Crystal symmetries; classification of solids and their bonding; electromagnetic, elastic, and particle waves in periodic lattices; thermal magnetic and dielectric properties of solids; energy bands of metals and semi-conductors; superconductivity; magnetism; ferroelectricity; magnetic resonances.
Solid State Physics: Read More [+]
Rules & Requirements

Prerequisites: 137A-137B; 137B may be taken concurrently

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Solid State Physics: Read Less [-]

PHYSICS 141B Solid State Physics 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Part II. A thorough introductory course in modern solid state physics. Crystal symmetries; classification of solids and their bonding; electromagnetic, elastic, and particle waves in periodic lattices; thermal magnetic and dielectric properties of solids; energy bands of metals and semi-conductors; superconductivity; magnetism; ferroelectricity; magnetic resonances.
Solid State Physics: Read More [+]
Rules & Requirements

Prerequisites: 137A-137B and 141A

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Solid State Physics: Read Less [-]

PHYSICS 142 Introduction to Plasma Physics 4 Units

Terms offered: Spring 2018, Spring 2016, Spring 2015
Motion of charged particles in electric and magnetic fields, dynamics of fully ionized plasma from both microscopic and macroscopic point of view, magnetohydrodynamics, small amplitude waves; examples from astrophysics, space sciences and controlled-fusion research.
Introduction to Plasma Physics: Read More [+]
Rules & Requirements

Prerequisites: 105, 110A-110B (110B may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Introduction to Plasma Physics: Read Less [-]

PHYSICS 151 Elective Physics: Special Topics 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Topics vary from semester to semester. The subject matter level and scope of the course are such that it is acceptable as the required elective course in the Physics major. See Department of Physics course announcements.
Elective Physics: Special Topics: Read More [+]
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Elective Physics: Special Topics: Read Less [-]

PHYSICS 153 Foundational Course for Physical Science Transfer Students 1 Unit

Terms offered: Fall 2020, Fall 2019
This course is designed to assist physics and other physical sciences transfer students in their transition to UC Berkeley. Over the course of a semester, students will learn about campus resources, how to navigate the campus, establish connections with other students in their cohorts, receive physics transfer peer mentorship and advising. Students will work in small-groups to solve challenging mathematical and physics concepts to assist with academic success.
Foundational Course for Physical Science Transfer Students: Read More [+]
Rules & Requirements

Prerequisites: Open only to physics and other physical sciences transfer students

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: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Foundational Course for Physical Science Transfer Students: Read Less [-]

PHYSICS C161 Relativistic Astrophysics and Cosmology 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Elements of general relativity. Physics of pulsars, cosmic rays, black holes. The cosmological distance scale, elementary cosmological models, properties of galaxies and quasars. The mass density and age of the universe. Evidence for dark matter and dark energy and concepts of the early universe and of galaxy formation. Reflections on astrophysics as a probe of the extrema of physics.
Relativistic Astrophysics and Cosmology: Read More [+]

Rules & Requirements

Prerequisites: 110A-110B; 112 (may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Instructors: Boggs, Holzapfel, A. Lee, Ma, Quataert

Also listed as: ASTRON C161

Relativistic Astrophysics and Cosmology: Read Less [-]

PHYSICS 177 Principles of Molecular Biophysics 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
We will review the structure of proteins, nucleic acids, carbohydrates, lipids, and the forces and interactions maintaining their structure in solution. We will describe the thermodynamics and kinetics of protein folding. The principles of polymer chain statistics and of helix-coil transitions in biopolymers will be reviewed next, together with biopolymer dynamics. We will then cover the main structural methods in biology: X-ray crystallography, MNR and fluorescence spectroscopy, electron and probe microscopy, and single molecular methods.
Principles of Molecular Biophysics: Read More [+]

Rules & Requirements

Prerequisites: 112 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: Physics/Undergraduate

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

Principles of Molecular Biophysics: Read Less [-]

PHYSICS 188 Bayesian Data Analysis and Machine Learning for Physical Sciences 4 Units

Terms offered: Fall 2020, Fall 2019
The course design covers data analysis and machine learning, highlighting their importance to the physical sciences. It covers data analysis with linear and nonlinear regression, logistic regression, and gaussian processes. It covers concepts in machine learning such as unsupervised and supervised regression and classification learning. It develops Bayesian statistics and information theory, covering concepts such as information, entropy, posteriors, MCMC, latent variables, graphical models and hierarchical Bayesian modeling. It covers numerical analysis topics such as integration and ODE, linear algebra, multi-dimensional optimization, and Fourier transforms.
Bayesian Data Analysis and Machine Learning for Physical Sciences: Read More [+]

Rules & Requirements

Prerequisites: Physics 77 or Data Science 8 or Computer Science 61A or an introductory Python course, or equivalent, or permission from instructor; Physics 89 or Mathematics 54 or Electrical Engineering 16A/B

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Bayesian Data Analysis and Machine Learning for Physical Sciences: Read Less [-]

PHYSICS H190 Physics Honors Course 2 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
A seminar which includes study and reports on current theoretical and experimental problems. Open only to students officially in the physics honors program or with consent of instructor.
Physics Honors Course: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Physics Honors Course: Read Less [-]

PHYSICS C191 Quantum Information Science and Technology 3 Units

Terms offered: Fall 2020, Spring 2020, Spring 2019
This multidisciplinary course provides an introduction to fundamental conceptual aspects of quantum mechanics from a computational and informational theoretic perspective, as well as physical implementations and technological applications of quantum information science. Basic sections of quantum algorithms, complexity, and cryptography, will be touched upon, as well as pertinent physical realizations from nanoscale science and engineering.
Quantum Information Science and Technology: Read More [+]
Rules & Requirements

Prerequisites: Linear Algebra (EECS 16A or PHYSICS 89 or MATH 54) AND either discrete mathematics (COMPSCI 70 or MATH 55), or quantum mechanics (PHYSICS 7C or PHYSICS 137A or CHEM 120A)

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

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

Also listed as: CHEM C191/COMPSCI C191

Quantum Information Science and Technology: Read Less [-]

PHYSICS H195A Senior Honors Thesis Research 2 Units

Terms offered: Fall 2019, Spring 2016, Fall 2015
Thesis work under the supervision of a faculty member. To obtain credit the student must, at the end of two semesters, submit a satisfactory thesis. A total of four units must be taken. The units may be distributed between one or two semesters in any way.
Senior Honors Thesis Research: Read More [+]
Rules & Requirements

Prerequisites: Open only to students in the honors program

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Letter grade. This is part one of a year long series course. A provisional grade of IP (in progress) will be applied and later replaced with the final grade after completing part two of the series. Final exam not required.

Senior Honors Thesis Research: Read Less [-]

PHYSICS H195B Senior Honors Thesis Research 2 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015
Thesis work under the supervision of a faculty member. To obtain credit the student must, at the end of two semesters, submit a satisfactory thesis. A total of four units must be taken. The units may be distributed between one or two semesters in any way.
Senior Honors Thesis Research: Read More [+]
Rules & Requirements

Prerequisites: Open only to students in the honors program

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Letter grade. This is part two of a year long series course. Upon completion, the final grade will be applied to both parts of the series. Final exam not required.

Senior Honors Thesis Research: Read Less [-]

PHYSICS 198 Directed Group Study 1 - 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Enrollment restrictions apply; see the Introduction to Courses and Curricula section in this catalog.
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 - 2.5-10 hours of directed group study per week
8 weeks - 1.5-7.5 hours of directed group study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study: Read Less [-]

PHYSICS 198BC Berkeley Connect 1 Unit

Terms offered: Fall 2020, Spring 2020, Fall 2019
Berkeley Connect is a mentoring program, offered through various academic departments, that helps students build intellectual community. Over the course of a semester, enrolled students participate in regular small-group discussions facilitated by a graduate student mentor (following a faculty-directed curriculum), meet with their graduate student mentor for one-on-one academic advising, attend lectures and panel discussions featuring department faculty and alumni, and go on field trips to campus resources. Students are not required to be declared majors in order to participate.
Berkeley Connect: 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 directed group study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Berkeley Connect: Read Less [-]

PHYSICS 198F Frontiers of Physics 2 Units

Terms offered: Prior to 2007
Discussion-based introduction to contemporary research in physics for advanced undergraduates. Presentation of different weekly topics in physics research led by graduate students, postdocs, or professors in a particular field to connect upper division physics majors with contemporary research and to increase dialogue between upper division undergraduates and researchers in the department.
Frontiers of Physics: Read More [+]
Objectives & Outcomes

Course Objectives: -- To connect upper division physics majors with contemporary research in a way that traditional coursework does not.
-- To connect upper division physics majors with contemporary research in a way that traditional coursework does not.
-- To increase dialogue between upper division undergraduates and researchers in the department.
-- To help undergraduates make more informed career choices.

Student Learning Outcomes: -- Students left the course with a more broadened and more concrete understanding of what “pursuing research in physics” consists of. They also found themselves interested in areas of physics they didn’t expect or hadn’t known existed.
-- Students gained connections in the department. This has resulted in research projects for several students
-- Students received mentoring from the graduate student on many career path issues.
-- Small class size and discussion format strengthened the physics community both laterally and vertically.

Rules & Requirements

Prerequisites: Physics 7A, 7B, 7C or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of directed group study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Alternative to final exam.

Frontiers of Physics: Read Less [-]

PHYSICS 199 Supervised Independent Study 1 - 3 Units

Terms offered: Fall 2016, Spring 2016, Fall 2015
Enrollment restrictions apply; see the Introduction to Courses and Curricula section in this catalog.
Supervised Independent Study: 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

Summer:
6 weeks - 2.5-7.5 hours of independent study per week
8 weeks - 1.5-5.5 hours of independent study per week
10 weeks - 1.5-4.5 hours of independent study per week

Additional Details

Subject/Course Level: Physics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study: Read Less [-]

PHYSICS C201 Introduction to Nano-Science and Engineering 3 Units

Terms offered: Spring 2015, Spring 2013, Spring 2012
A three-module introduction to the fundamental topics of Nano-Science and Engineering (NSE) theory and research within chemistry, physics, biology, and engineering. This course includes quantum and solid-state physics; chemical synthesis, growth fabrication, and characterization techniques; structures and properties of semiconductors, polymer, and biomedical materials on nanoscales; and devices based on nanostructures. Students must take this course to satisfy the NSE Designated Emphasis core requirement.
Introduction to Nano-Science and Engineering: Read More [+]
Rules & Requirements

Prerequisites: Major in physical science such as chemistry, physics, etc., or engineering; consent of advisor or 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: Physics/Graduate

Grading: Letter grade.

Instructors: Gronsky, S.W. Lee, Wu

Also listed as: BIO ENG C280/MAT SCI C261/NSE C201

Introduction to Nano-Science and Engineering: Read Less [-]

PHYSICS C202 Astrophysical Fluid Dynamics 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Principles of gas dynamics, self-gravitating fluids, magnetohydrodynamics and elementary kinetic theory. Aspects of convection, fluid oscillations, linear instabilities, spiral density waves, shock waves, turbulence, accretion disks, stellar winds, and jets.
Astrophysical Fluid Dynamics: Read More [+]
Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Instructors: Chiang, Kasen, Ma, Quataert, White

Also listed as: ASTRON C202

Astrophysical Fluid Dynamics: Read Less [-]

PHYSICS C203 Computational Nanoscience 3 Units

Terms offered: Spring 2009, Spring 2008, Spring 2006
A multidisciplinary overview of computational nanoscience for both theorists and experimentalists. This course teaches the main ideas behind different simulation methods; how to decompose a problem into "simulatable" constituents; how to simulate the same thing two different ways; knowing what you are doing and why thinking is still important; the importance of talking to experimentalists; what to do with your data and how to judge its validity; why multiscale modeling is both important and nonsense.
Computational Nanoscience: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing 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: Physics/Graduate

Grading: Letter grade.

Also listed as: NSE C242

Computational Nanoscience: Read Less [-]

PHYSICS 205A Advanced Dynamics 4 Units

Terms offered: Spring 2019, Spring 2017, Spring 2015
Lagrange and Hamiltonian dynamics, variational methods, symmetry, kinematics and dynamics of rotation, canonical variables and transformations, perturbation theory, nonlinear dynamics, KAM theory, solitons and integrable pdes.
Advanced Dynamics: Read More [+]
Rules & Requirements

Prerequisites: 105 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Advanced Dynamics: Read Less [-]

PHYSICS 205B Advanced Dynamics 4 Units

Terms offered: Spring 2020, Spring 2018, Fall 2015
Nonlinear dynamics of dissipative systems, attractors, perturbation theory, bifurcation theory, pattern formation. Emphasis on recent developments, including turbulence.
Advanced Dynamics: Read More [+]
Rules & Requirements

Prerequisites: 205A

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Advanced Dynamics: Read Less [-]

PHYSICS C207 Radiation Processes in Astronomy 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
An introduction to the basic physics of astronomy and astrophysics at the graduate level. Principles of energy transfer by radiation. Elements of classical and quantum theory of photon emission; bremsstrahlung, cyclotron and synchrotron radiation. Compton scattering, atomic, molecular and nuclear electromagnetic transitions. Collisional excitation of atoms, molecules and nuclei.
Radiation Processes in Astronomy: Read More [+]
Rules & Requirements

Prerequisites: Physics 105, 110A; 110B concurrently; open to advanced undergraduates with GPA of 3.70

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Instructors: Chiang, Kasen, Quataert

Also listed as: ASTRON C207

Radiation Processes in Astronomy: Read Less [-]

PHYSICS 209 Classical Electromagnetism 5 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Maxwell's equations, gauge transformations and tensors. Complete development of special relativity, with applications. Plane waves in material media, polarization, Fresnel equations, attenuation, and dispersion. Wave equation with sources, retarded solution for potentials, and fields. Cartesian and spherical multipole expansions, vector spherical harmonics, examples of radiating systems, diffraction, and optical theorem. Fields of charges in arbitrary motion, radiated power, relativistic (synchrotron) radiation, and radiation in collisions.
Classical Electromagnetism: Read More [+]
Rules & Requirements

Prerequisites: 110A-110B 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: Physics/Graduate

Grading: Letter grade.

Classical Electromagnetism: Read Less [-]

PHYSICS 211 Equilibrium Statistical Physics 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Foundations of statistical physics. Ensemble theory. Degenerate systems. Systems of interacting particles.
Equilibrium Statistical Physics: Read More [+]
Rules & Requirements

Prerequisites: 112 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Equilibrium Statistical Physics: Read Less [-]

PHYSICS 212 Nonequilibrium Statistical Physics 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Time dependent processes. Kinetic equations. Transport processes. Irreversibility. Theory of many-particle systems. Critical phenomena and renormalization group. Theory of phase transitions.
Nonequilibrium Statistical Physics: Read More [+]
Rules & Requirements

Prerequisites: 112 and 221A-221B, or equivalents

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Nonequilibrium Statistical Physics: Read Less [-]

PHYSICS 216 Special Topics in Many-Body Physics 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Quantum theory of many-particle systems. Applications of theory and technique to physical systems. Pairing phenomena, superfluidity, equation of state, critical phenomena, phase transitions, nuclear matter.
Special Topics in Many-Body Physics: Read More [+]
Rules & Requirements

Prerequisites: 221A-221B or equivalent 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: Physics/Graduate

Grading: Letter grade.

Special Topics in Many-Body Physics: Read Less [-]

PHYSICS C218 Modern Optical Microscopy for the Modern Biologist 3 Units

Terms offered: Not yet offered
This course is intended for graduate students in the early stages of their thesis research who are contemplating using modern microscopy tools as part of their work. It endeavors to cut through the confusion of the wide array of new imaging methods, with a practical description of the pros and cons of each. In addition to providing an intuitive physical understanding how these microscopes work, the course will offer hands on experience with cutting-edge microscopes where students will be able to see firsthand how different imaging modalities perform on their own samples, and where they will be able to access computational tools for the visualization and analysis of their data.
Modern Optical Microscopy for the Modern Biologist: Read More [+]
Rules & Requirements

Credit Restrictions: Students will receive no credit for MCELLBI 205 after completing MCELLBI 205, or MCELLBI 205. A deficient grade in MCELLBI 205 may be removed by taking MCELLBI 205, or MCELLBI 205.

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Instructors: Betzig, Ji

Formerly known as: Molecular and Cell Biology 205

Also listed as: MCELLBI C205

Modern Optical Microscopy for the Modern Biologist: Read Less [-]

PHYSICS 221A Quantum Mechanics 5 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Basic assumptions of quantum mechanics; quantum theory of measurement; matrix mechanics; Schroedinger theory; symmetry and invariance principles; theory of angular momentum; stationary state problems; variational principles; time independent perturbation theory; time dependent perturbation theory; theory of scattering.
Quantum Mechanics: Read More [+]
Rules & Requirements

Prerequisites: 137A-137B or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Quantum Mechanics: Read Less [-]

PHYSICS 221B Quantum Mechanics 5 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Many-body methods, radiation field quantization, relativistic quantum mechanics, applications.
Quantum Mechanics: Read More [+]
Rules & Requirements

Prerequisites: 221A

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Quantum Mechanics: Read Less [-]

PHYSICS 226 Particle Physics Phenomenology 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Introduction to particle physics phenomena. Emphasis is placed on experimental tests of particle physics models. Topics include Quark model spectroscopy; weak decays; overview of detectors and accelerators; e+e- annihilation; parton model; electron-proton and neutrino-proton scattering; special topics of current interest.
Particle Physics Phenomenology: Read More [+]
Rules & Requirements

Prerequisites: 221A-221B or equivalent 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: Physics/Graduate

Grading: Letter grade.

Particle Physics Phenomenology: Read Less [-]

PHYSICS C228 Extragalactic Astronomy and Cosmology 3 Units

Terms offered: Fall 2016, Fall 2015, Fall 2014
A survey of physical cosmology - the study of the origin, evolution, and fate of the universe. Topics include the Friedmann-Robertson-Walker model, thermal history and big bang nucleosynthesis, evidence and nature of dark matter and dark energy, the formation and growth of galaxies and large scale structure, the anisotropy of the cosmic microwave radiation, inflation in the early universe, tests of cosmological models, and current research areas. The course complements the material of Astronomy 218.
Extragalactic Astronomy and Cosmology: Read More [+]
Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Instructors: Holzapfel, Lee, Ma, Seljak, White

Also listed as: ASTRON C228

Extragalactic Astronomy and Cosmology: Read Less [-]

PHYSICS 229 Advanced Cosmology 3 Units

Terms offered: Spring 2019, Spring 2017, Spring 2016
Advanced topics in physical and early-universe cosmology. Topics include the expanding Universe, evidence and nature of dark matter and dark energy, relativistic perturbation theory, models of cosmological inflation, the formation and growth of large scale structure and the anisotropy of the cosmic microwave background, and current research areas. The course extends the material of C228.
Advanced Cosmology: Read More [+]

Rules & Requirements

Prerequisites: Physics/Astronomy C228 or equivalent or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Advanced Cosmology: Read Less [-]

PHYSICS 231 General Relativity 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
An introduction to Einstein's theory of gravitation. Tensor analysis, general relativistic models for matter and electromagnetism, Einstein's field equations. Applications, for example, to the solar system, dense stars, black holes, and cosmology.
General Relativity: Read More [+]

Rules & Requirements

Prerequisites: Physics 110B or Physics 139 (or equivalent) or consent of instructor/department

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

General Relativity: Read Less [-]

PHYSICS 232A Quantum Field Theory I 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Introduction to quantum field theory: canonical quantization of scalar, electromagnetic, and Dirac fields; derivation of Feynman rules; regularization and renormalization; introduction to the renormalization group; elements of the path integral.
Quantum Field Theory I: Read More [+]

Rules & Requirements

Prerequisites: Concurrent enrollment in 221A or 221B 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: Physics/Graduate

Grading: Letter grade.

Quantum Field Theory I: Read Less [-]

PHYSICS 232B Quantum Field Theory II 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Renormalization of Yang-Mills gauge theories: BRST quantization of gauge theories; nonperturbative dynamics; renormalization group; basics of effective field theory; large N; solitons; instantons; dualities. Selected current topics.
Quantum Field Theory II: Read More [+]

Rules & Requirements

Prerequisites: 232A or equivalent 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: Physics/Graduate

Grading: Letter grade.

Quantum Field Theory II: Read Less [-]

PHYSICS 233A Standard Model and Beyond I 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Introduction to the Standard Model of particle physics and its applications: construction of the Standard Model; Higgs mechanism; phenomenology of weak interactions; QCD and the chiral Lagrangian; quark mixing and flavor physics.
Standard Model and Beyond I: Read More [+]
Rules & Requirements

Prerequisites: 232A or equivalent or consent of instructor (concurrent enrollment in 232B is 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: Physics/Graduate

Grading: Letter grade.

Standard Model and Beyond I: Read Less [-]

PHYSICS 233B Standard Model and Beyond II 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Advanced topics in the Standard Model and beyond, selected from: open problems in the Standard Model; supersymmetric models; grand unification; neutrino physics; flat and warped extra dimensions; axions; inflation; baryogenesis; dark matter; the multiverse; other current topics.
Standard Model and Beyond II: Read More [+]
Rules & Requirements

Prerequisites: 233A or equivalent or consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Standard Model and Beyond II: Read Less [-]

PHYSICS 234A String Theory I 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Perturbative theory of the bosonic strings, superstrings, and heterotic strings: NSR and GS formulations; 2d CFT; strings in background fields; T-duality; effective spacetime supergravity; perturbative description of D-branes; elements of compactifications and string phenomemology; perturbative mirror symmetry.
String Theory I: Read More [+]
Rules & Requirements

Prerequisites: 232A or equivalent or consent of instructor. 232B is 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: Physics/Graduate

Grading: Letter grade.

String Theory I: Read Less [-]

PHYSICS 234B String Theory II 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Nonperturbative apsects of string theory. Topics selected from black holes; black branes; Bekenstein-Hawking entropy; D-branes; string dualities; M-theory; holographic principle and its realizations; AdS/CFT correspondence; gauge theory/gravity dualities; flux compactifications; cosmology in string theory; topological string theories. Selected current topics.
String Theory II: Read More [+]
Rules & Requirements

Prerequisites: 234A or equivalent or consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

String Theory II: Read Less [-]

PHYSICS 238 Advanced Atomic, Molecular, and Optical Physics 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2017
Contemporary topics in atomic, molecular, and optical physics are presented at an advanced level. These topics may include one or several of the following, at the discretion of the instructor: mechanical effects of light-atom interactions, ultra-cold atomic physics, molecular physics, resonance optics of multi-level atoms, and probing particle physics with atoms and molecules.
Advanced Atomic, Molecular, and Optical Physics: Read More [+]
Rules & Requirements

Prerequisites: 110A, 130, 137A-137B, and 138; 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: Physics/Graduate

Grading: Letter grade.

Advanced Atomic, Molecular, and Optical Physics: Read Less [-]

PHYSICS 240A Quantum Theory of Solids 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Excitations and interactions in solids; crystal structures, symmetries, Bloch's theorem; energy bands; electron dynamics; impurity states; lattice dynamics, phonons; many-electron interactions; density functional theory; dielectric functions, conductivity and optical properties.
Quantum Theory of Solids: Read More [+]
Rules & Requirements

Prerequisites: 141A-141B and 221A-221B or equivalents, or consent of instructor; 240A is prerequisite to 240B

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Quantum Theory of Solids: Read Less [-]

PHYSICS 240B Quantum Theory of Solids 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
Optical properties, excitons; electron-phonon interactions, polarons; quantum oscillations, Fermi surfaces; magnetoresistance; quantum Hall effect; transport processes, Boltzmann equation; superconductivity, BCS theory; many-body perturbation theory, Green's functions.
Quantum Theory of Solids: Read More [+]
Rules & Requirements

Prerequisites: 141A-141B and 221A-221B or equivalents, or consent of instructor; 240A is prerequisite to 240B

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Quantum Theory of Solids: Read Less [-]

PHYSICS 242A Theoretical Plasma Physics 4 Units

Terms offered: Fall 2019, Fall 2017, Fall 2015
Analysis of plasma behavior according to the Vlasov, Fokker-Planck equations, guiding center and hydromagnetic descriptions. Study of equilibria, stability, linear and nonlinear waves, transport, and laser-plasma interactions.
Theoretical Plasma Physics: Read More [+]
Rules & Requirements

Prerequisites: Physics 142, 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: Physics/Graduate

Grading: Letter grade.

Theoretical Plasma Physics: Read Less [-]

PHYSICS 242B Theoretical Plasma Physics 4 Units

Terms offered: Spring 2020, Spring 2016, Spring 2012
Analysis of plasma behavior according to the Vlasov, Fokker-Planck equations, guiding center and hydromagnetic descriptions. Study of equilibria, stability, linear and nonlinear waves, transport, and laser-plasma interactions.
Theoretical Plasma Physics: Read More [+]
Rules & Requirements

Prerequisites: Physics 142, 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: Physics/Graduate

Grading: Letter grade.

Theoretical Plasma Physics: Read Less [-]

PHYSICS 250 Special Topics in Physics 2 - 4 Units

Terms offered: Fall 2019, Spring 2019, Fall 2015
Topics will vary from semester to semester. See Department of Physics announcements.
Special Topics in Physics: Read More [+]
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Special Topics in Physics: Read Less [-]

PHYSICS 251 Introduction to Graduate Research in Physics 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018
A survey of experimental and theoretical research in the Department of Physics, designed for first-year graduate students. One regular meeting each week with supplementary visits to experimental laboratories. Meetings include discussions with research staff.
Introduction to Graduate Research in Physics: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing in Department of Physics or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Introduction to Graduate Research in Physics: Read Less [-]

PHYSICS C254 High Energy Astrophysics 3 Units

Terms offered: Fall 2018, Spring 2017, Spring 2014
Basic physics of high energy radiation processes in an astrophysics environment. Cosmic ray production and propagation. Applications selected from pulsars, x-ray sources, supernovae, interstellar medium, extragalactic radio sources, quasars, and big-bang cosmologies.
High Energy Astrophysics: Read More [+]
Rules & Requirements

Prerequisites: 201 or consent of instructor. 202 recommended

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Letter grade.

Instructors: Boggs, Quataert

Formerly known as: Physics C254, Astronomy C254

Also listed as: ASTRON C254

High Energy Astrophysics: Read Less [-]

PHYSICS C285 Theoretical Astrophysics Seminar 1 Unit

Terms offered: Fall 2020, Spring 2020, Fall 2019, Spring 2019, Fall 2018
The study of theoretical astrophysics.
Theoretical Astrophysics Seminar: Read More [+]
Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructor: Quataert

Also listed as: ASTRON C285

Theoretical Astrophysics Seminar: Read Less [-]

PHYSICS 288 Bayesian Data Analysis and Machine Learning for Physical Sciences 4 Units

Terms offered: Fall 2020, Fall 2019
The course design covers data analysis and machine learning, highlighting their importance to the physical sciences. It covers data analysis with linear and nonlinear regression, logistic regression, and gaussian processes. It covers concepts in machine learning such as unsupervised and supervised regression and classification learning. It develops Bayesian statistics and information theory, covering concepts such as information, entropy, posteriors, MCMC, latent variables, graphical models and hierarchical Bayesian modeling. It covers numerical analysis topics such as integration and ODE, linear algebra, multi-dimensional optimization, and Fourier transforms.
Bayesian Data Analysis and Machine Learning for Physical Sciences: 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: Physics/Graduate

Grading: Letter grade.

Bayesian Data Analysis and Machine Learning for Physical Sciences: Read Less [-]

PHYSICS 290A Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290B Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290D Seminar 2 Units

Terms offered: Fall 2005, Fall 2004, Fall 2003
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290E Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290F Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290G Seminar 2 Units

Terms offered: Fall 2006, Spring 2006, Fall 2005
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290H Seminar 2 Units

Terms offered: Spring 2017, Spring 2016, Spring 2015
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290I Seminar 2 Units

Terms offered: Spring 2014, Spring 1999, Spring 1998
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290J Seminar 2 Units

Terms offered: Prior to 2007
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290K Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290L Seminar 2 Units

Terms offered: Fall 2012, Fall 2000
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290N Seminar in Non-Neutral Plasmas 2 Units

Terms offered: Spring 2007, Fall 2006, Spring 2006
Seminar in Non-Neutral Plasmas: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar in Non-Neutral Plasmas: Read Less [-]

PHYSICS 290P Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290Q Seminar in Quantum Optics 2 Units

Terms offered: Prior to 2007
Seminar in Quantum Optics: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar in Quantum Optics: Read Less [-]

PHYSICS 290R Seminar 2 Units

Terms offered: Prior to 2007
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290S Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290T Seminar 2 Units

Terms offered: Spring 2000, Fall 1999, Spring 1999
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290X Seminar 2 Units

Terms offered: Fall 2006, Spring 2006, Fall 2005
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290Y Seminar 2 Units

Terms offered: Fall 2006, Spring 2006, Fall 2005
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS 290Z Seminar 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminar: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Seminar: Read Less [-]

PHYSICS C290C Cosmology 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Cosmology: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructors: White, Cohn

Formerly known as: Physics C290C, Astronomy C290C

Also listed as: ASTRON C290C

Cosmology: Read Less [-]

PHYSICS 295 Special Study for Graduate Students 1 - 4 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
This course is arranged to allow qualified graduate students to investigate possible research fields or to pursue problems of interest through reading or non-laboratory study under the direction of faculty members who agree to give such supervision.
Special Study for Graduate Students: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing

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 - 1-4 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Special Study for Graduate Students: Read Less [-]

PHYSICS 297 Careers for Physical Science PhDs 1 Unit

Terms offered: Spring 2018
This course exposes graduate students and postdocs in the physical sciences to non-academic careers. Each session hosts speakers who have transitioned from a PhD in the physical sciences to a variety of industries, including data science, quantitative finance, software/hardware engineering, consulting, and more.
Careers for Physical Science PhDs: 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 seminar per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Careers for Physical Science PhDs: Read Less [-]

PHYSICS 299 Research 1 - 12 Units

Terms offered: Fall 2020, Spring 2017, Spring 2016
Research: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing

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

Summer:
6 weeks - 1-12 hours of independent study per week
8 weeks - 1-12 hours of independent study per week

Additional Details

Subject/Course Level: Physics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Research: Read Less [-]

PHYSICS 301 Advanced Professional Preparation: Supervised Teaching of Physics 1 - 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Discussion, problem review and development, guidance of physics laboratory experiments, course development.
Advanced Professional Preparation: Supervised Teaching of Physics: Read More [+]
Rules & Requirements

Prerequisites: 300

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

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of independent study per week

Additional Details

Subject/Course Level: Physics/Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

Advanced Professional Preparation: Supervised Teaching of Physics: Read Less [-]

PHYSICS 375 Professional Preparation: Supervised Teaching of Physics 2 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Mandatory for first time GSIs. Topics include teaching theory, effective teaching methods, educational objectives, alternatives to standard classroom methods, reciprocal classroom visitations, and guided group and self-analysis of videotapes.
Professional Preparation: Supervised Teaching of Physics: Read More [+]

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor; may be taken concurrently with 301

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: Physics/Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

Formerly known as: Physics 300

Professional Preparation: Supervised Teaching of Physics: Read Less [-]

PHYSICS 602 Individual Study for Doctoral Students 1 - 8 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015
Individual study in consultation with the major field adviser intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D.
Individual Study for Doctoral Students: Read More [+]

Rules & Requirements

Prerequisites: For qualified graduate students

Credit Restrictions: Course does not satisfy unit or residence requirements for doctoral degree.

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

Hours & Format

Fall and/or spring: 15 weeks - 1-8 hours of independent study per week

Summer:
6 weeks - 1-8 hours of independent study per week
8 weeks - 1-8 hours of independent study per week

Additional Details

Subject/Course Level: Physics/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.

Individual Study for Doctoral Students: Read Less [-]

PHYSICS 700 Departmental Colloquium 0.0 Units

Terms offered: Spring 2017, Fall 2016
Physics Department weekly colloquium.
Departmental Colloquium: Read More [+]

Hours & Format

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

Additional Details

Subject/Course Level: Physics/Graduate examination preparation

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

Formerly known as: Physics 800

Departmental Colloquium: Read Less [-]