Physics

Overview

Physics at UC Berkeley has long been in 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 twenty 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 to 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, PhD graduate students, undergraduate students, and visiting scholars. Research opportunities exist for investigating a wide range of topics in theoretical and experimental physics including 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/2014-15/undergraduate/degree-programs/physics) : BA

Graduate Program

Physics (http://guide.berkeley.edu/archive/2014-15/graduate/degree-programs/physics) : PhD

Physics

PHYSICS 7A Physics for Scientists and Engineers 4 Units
Mechanics and wave motion.
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 7B Physics for Scientists and Engineers 4 Units
Heat, electricity, and magnetism.
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 7C Physics for Scientists and Engineers 4 Units
Electromagnetic waves, optics, relativity, and quantum physics.
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 H7A Physics for Scientists and Engineers 4 Units
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.
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 H7B Physics for Scientists and Engineers 4 Units
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.
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 H7C Physics for Scientists and Engineers 4 Units
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.
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 8A Introductory Physics 4 Units
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.
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.

PHYSICS 8B Introductory Physics 4 Units
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.
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.

PHYSICS C10 Descriptive Introduction to Physics 3 Units
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.
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

PHYSICS 21 Physics of Music 3 Units
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.
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 C21 Physics and Music 3 Units
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.
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 24 Freshman Seminars 1 Unit
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.
Rules & Requirements

Repeat rules: Course may be repeated for credit as topic varies. 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.

PHYSICS 39 Lower Division Physics Seminar 1.5 - 4 Units
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.
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. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1.5-4 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.

PHYSICS 49 Supplementary Work in Lower Division Physics 1 - 3 Units
Students with partial credit in lower division physics courses may, with consent of instructor, complete the credit under this heading.
Rules & Requirements

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

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.

PHYSICS 77 Introduction to Computational Techniques in Physics 2 Units
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.
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.

PHYSICS 89 Introduction to Mathematical Physics 4 Units
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.
Rules & Requirements

Prerequisites: MATH 53

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.

PHYSICS 98 Directed Group Study 1 - 4 Units
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 as topic varies. 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.

PHYSICS 98BC Berkeley Connect 1 Unit
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.
Rules & Requirements

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

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.

PHYSICS 99 Supervised Independent Study 1 - 3 Units
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 as topic varies. 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.

PHYSICS 100 Communicating Physics and Physical Science 2 Units
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.
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.

PHYSICS 105 Analytic Mechanics 4 Units
Newtonian mechanics, motion of a particle in one, two, and three dimensions, Larange's equations, Hamilton's equations, central force motion, moving coordinate systems, mechanics of continuous media, oscillations, normal modes, rigid body dynamics, tensor analysis techniques.
Rules & Requirements

Prerequisites: PHYSICS 7A, 7B, 7C

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.

PHYSICS 110A Electromagnetism and Optics 4 Units
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.
Rules & Requirements

Prerequisites: PHYSICS 7A, 7B, 7C

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.

PHYSICS 110B Electromagnetism and Optics 4 Units
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.
Rules & Requirements

Prerequisites: PHYSICS 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.

PHYSICS 111A Instrumentation Laboratory 3 Units
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.
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.

PHYSICS 111B Advanced Experimentation Laboratory 1 - 3 Units
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.
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 a maximum of REPEAT_REQUIRES_INSTRUCTOR_CONSENT units. Course may be repeated for credit when topic changes.

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

PHYSICS 112 Introduction to Statistical and Thermal Physics 4 Units
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.
Rules & Requirements

Prerequisites: PHYSICS 7A, 7B, 7C

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.

PHYSICS 129 Particle Physics 4 Units
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.
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. Final exam required.

Formerly known as: 129A

PHYSICS 130 Quantum and Nonlinear Optics 3 Units
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.
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.

PHYSICS 137A Quantum Mechanics 4 Units
Part I. Introduction to the methods of quantum mechanics with applications to atomic, molecular, solid state, nuclear and elementary particle physics.
Rules & Requirements

Prerequisites: PHYSICS 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.

PHYSICS 137B Quantum Mechanics 4 Units
Part II. Introduction to the methods of quantum mechanics with applications to atomic, molecular, solid state, nuclear and elementary particle physics.
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.

PHYSICS 138 Modern Atomic Physics 3 Units
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.
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.

PHYSICS 139 Special Relativity and General Relativity 3 Units
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.
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.

PHYSICS 141A Solid State Physics 4 Units
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.
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.

PHYSICS 141B Solid State Physics 3 Units
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.
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.

PHYSICS 142 Introduction to Plasma Physics 4 Units
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.
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.

PHYSICS 151 Elective Physics: Special Topics 3 Units
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.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit as topic varies. 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.

PHYSICS C161 Relativistic Astrophysics and Cosmology 4 Units
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.
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, Davis, Holzapfel, A. Lee, Ma, Quataert

Formerly known as: C160B and Physics C160B

Also listed as: ASTRON C161

PHYSICS 177 Principles of Molecular Biophysics 3 Units
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.
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.

PHYSICS H190 Physics Honors Course 2 Units
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.
Rules & Requirements

Prerequisites: Consent of instructor

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

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 C191 Quantum Information Science and Technology 3 Units
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.
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.

Instructors: Crommie, Vazirani, Whaley

Also listed as: CHEM C191/COMPSCI C191

PHYSICS H195A Senior Honors Thesis Research 2 Units
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.
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.

PHYSICS H195B Senior Honors Thesis Research 2 Units
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.
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.

PHYSICS 198 Directed Group Study 1 - 4 Units
Enrollment restrictions apply; see the Introduction to Courses and Curricula section in this catalog.
Rules & Requirements

Repeat rules: Course may be repeated for credit. 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:
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.

PHYSICS 198BC Berkeley Connect 1 Unit
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.
Rules & Requirements

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

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.

PHYSICS 199 Supervised Independent Study 1 - 3 Units
Enrollment restrictions apply; see the Introduction to Courses and Curricula section in this catalog.
Rules & Requirements

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

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.

PHYSICS C201 Introduction to Nano-Science and Engineering 3 Units
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.
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 when topic changes.

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

PHYSICS C202 Astrophysical Fluid Dynamics 4 Units
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.
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

PHYSICS C203 Computational Nanoscience 3 Units
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.
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

PHYSICS 205A Advanced Dynamics 4 Units
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.
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.

PHYSICS 205B Advanced Dynamics 4 Units
Nonlinear dynamics of dissipative systems, attractors, perturbation theory, bifurcation theory, pattern formation. Emphasis on recent developments, including turbulence.
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.

PHYSICS C207 Radiation Processes in Astronomy 4 Units
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.
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: Bower, Chiang, Kasen, Quataert

Also listed as: ASTRON C207

PHYSICS 209 Classical Electromagnetism 5 Units
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.
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.

PHYSICS 211 Equilibrium Statistical Physics 4 Units
Foundations of statistical physics. Ensemble theory. Degenerate systems. Systems of interacting particles.
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.

PHYSICS 212 Nonequilibrium Statistical Physics 4 Units
Time dependent processes. Kinetic equations. Transport processes. Irreversibility. Theory of many-particle systems. Critical phenomena and renormalization group. Theory of phase transitions.
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.

PHYSICS 216 Special Topics in Many-Body Physics 4 Units
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.
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.

PHYSICS 221A Quantum Mechanics 5 Units
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.
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.

PHYSICS 221B Quantum Mechanics 5 Units
Many-body methods, radiation field quantization, relativistic quantum mechanics, applications.
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.

PHYSICS 226 Particle Physics Phenomenology 4 Units
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.
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.

PHYSICS C228 Extragalactic Astronomy and Cosmology 3 Units
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.
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: Davis, Holzapfel, Lee, Ma, Seljak, White

Also listed as: ASTRON C228

PHYSICS 229 Advanced Cosmology 3 Units
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.
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.

PHYSICS 231 General Relativity 4 Units
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.
Rules & Requirements

Prerequisites: 209 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.

PHYSICS 232A Quantum Field Theory I 4 Units
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.
Rules & Requirements

Prerequisites: 221A-221B or equivalent or consent of instructor (concurrent enrollment in 226 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.

PHYSICS 232B Quantum Field Theory II 4 Units
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.
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.

PHYSICS 233A Standard Model and Beyond I 4 Units
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.
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.

PHYSICS 233B Standard Model and Beyond II 4 Units
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.
Rules & Requirements

Prerequisites: 233A or equivalent or consent of instructor

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

Grading: Letter grade.

PHYSICS 234A String Theory I 4 Units
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.
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.

PHYSICS 234B String Theory II 4 Units
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.
Rules & Requirements

Prerequisites: 234A or equivalent or consent of instructor

Repeat rules: May be repeated for credit with consent of instructor. 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/Graduate

Grading: Letter grade.

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

PHYSICS 240A Quantum Theory of Solids 4 Units
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.
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.

PHYSICS 240B Quantum Theory of Solids 4 Units
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.
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.

PHYSICS 242A Theoretical Plasma Physics 4 Units
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.
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.

PHYSICS 242B Theoretical Plasma Physics 4 Units
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.
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.

PHYSICS 250 Special Topics in Physics 2 - 4 Units
Topics will vary from semester to semester. See Department of Physics announcements.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit with consent of instructor. Course may be repeated for credit when topic changes.

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.

PHYSICS 251 Introduction to Graduate Research in Physics 1 Unit
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.
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.

PHYSICS C254 High Energy Astrophysics 3 Units
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.
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

Also listed as: ASTRON C254

PHYSICS C285 Theoretical Astrophysics Seminar 1 Unit
The study of theoretical astrophysics.
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

PHYSICS 290A Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290B Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290D Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290E Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290F Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290G Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290H Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290I Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290J Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290K Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290L Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290N Seminar in Non-Neutral Plasmas 2 Units
Rules & Requirements

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

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.

PHYSICS 290P Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290Q Seminar in Quantum Optics 2 Units
Rules & Requirements

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

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.

PHYSICS 290R Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290S Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290T Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290X Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290Y Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS 290Z Seminar 2 Units
Rules & Requirements

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

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.

PHYSICS C290C Cosmology 2 Units
Rules & Requirements

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

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

Also listed as: ASTRON C290C

PHYSICS 295 Special Study for Graduate Students 1 - 4 Units
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.
Rules & Requirements

Prerequisites: Graduate standing

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:
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.

PHYSICS 299 Research 1 - 12 Units
Rules & Requirements

Prerequisites: Graduate standing

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

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.

PHYSICS 301 Advanced Professional Preparation: Supervised Teaching of Physics 1 - 2 Units
Discussion, problem review and development, guidance of physics laboratory experiments, course development.
Rules & Requirements

Prerequisites: 300

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

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.

PHYSICS 375 Professional Preparation: Supervised Teaching of Physics 2 Units
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.
Rules & Requirements

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

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

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

PHYSICS 602 Individual Study for Doctoral Students 1 - 8 Units
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.
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. Course may be repeated for credit when topic changes.

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.