Physics

Graduate work leading to the PhD degree is offered in the Department of Physics. Students may petition for an MA degree on their way to a PhD. Please note that the department will not consider applications from students who intend to work toward the MA degree only. In certain cases, students may petition for a terminal MA degree. Research is a major part of the PhD program, and research opportunities exist across the full spectrum of theoretical and experimental physics, including astrophysics and cosmology; atomic, molecular and optical physics; biophysics; condensed matter; elementary particles and fields; fusion and plasma; low-temperature physics; mathematical physics; nuclear physics; quantum information; space physics; and statistical mechanics.

At the Lawrence Berkeley National Laboratory, extensive opportunities exist for research in astrophysics, elementary particle and nuclear physics, condensed matter physics and materials science, and plasma and nuclear physics. Space physics, interplanetary studies, solar plasma research, physics of the upper atmosphere, and cosmological problems are pursued both in the Physics Department and at the Space Sciences Laboratory.

Admission to the University

Minimum Requirements for Admission

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

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

Applicants Who Already Hold a Graduate Degree

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

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

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

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

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

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

Required Documents for Applications

1. **Transcripts:** Applicants may upload *unofficial* transcripts with your application for the departmental initial review. *If the applicant is admitted,* then *official* transcripts of all college-level work will be required. Official transcripts must be in sealed envelopes as issued by the school(s) attended. If you have attended Berkeley, upload your unofficial transcript with your application for the departmental initial review. *If you are admitted,* an official transcript with evidence of degree conferral *will not* be required.
2. **Letters of recommendation:** Applicants may request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants who have completed a basic degree from a country or political entity in which the official language is not English are required to submit official evidence of English language proficiency. This applies to institutions from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, most European countries, and Quebec (Canada). However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a US university may submit an official transcript from the US university to fulfill this requirement. The following courses will not fulfill this requirement:
    - courses in English as a Second Language,
    - courses conducted in a language other than English,
    - courses that will be completed after the application is submitted, and
    - courses of a non-academic nature.

If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests. Official TOEFL score reports must be sent directly from Educational Test Services (ETS). The institution code for Berkeley is 4833. Official IELTS score reports must be sent electronically from the testing center to University of California, Berkeley, Graduate Division, Sproul Hall, Rm 318 MC 5900, Berkeley, CA 94720. TOEFL and IELTS score reports are only valid for two years.

Where to Apply

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

Admission to the Program

The Department of Physics ordinarily admits only those applicants who have scholastic records well above a B+ average and who have completed the equivalent of the undergraduate major in physics. This program includes upper division courses in mechanics (4 semester units), electromagnetism and optics (8 semester units), statistical and thermal physics (4 semester units), quantum mechanics (8 semester units), and advanced undergraduate laboratory (5 semester units). Courses in atomic, nuclear and solid state physics, astronomy and applied mathematics are recommended as electives. Not all courses in the major are required for admission. Some courses required for the major program but not previously taken may have to be made up in the first year of graduate work. Applicants are required to submit a list of courses taken in physics and mathematics with course number, and applicable textbook, as well as a list of courses in progress.

In determining the admissibility of a prospective graduate student the department attempts to carefully weigh all relevant factors, including transcripts of academic work, scores on the General and Physics-Subject GRE, letters of recommendation, research experience, and a statement of purpose. We recognize the diverse experiences of our applicants and therefore encourage them to submit supporting materials.

The Graduate Program in Physics is designed for those intending to pursue work leading to the PhD. After completing the necessary course work and examination requirements, an MA degree can be awarded. However, the department does not consider applications from those intending to work toward the MA degree only.

The master's degree in Physics is conferred according to Graduate Division degree policies. Students in the physics doctoral program may apply for the MA degree. The Physics MA candidate must complete:

1) Curriculum

PHYSICS 209	Classical Electromagnetism	5
PHYSICS 211	Equilibrium Statistical Physics	4
PHYSICS 221A	Quantum Mechanics	5
PHYSICS 221B	Quantum Mechanics	5

Note: Required courses (19.0 units) must be taken for a letter grade or 19 replacement units if subject waivers have been granted for prior coursework.

2) 16 additional units of approved upper division and graduate courses, which may include PHYSICS 251 **and** PHYSICS 375

Note: Total units required for MA degree is 35 semester units of upper division and graduate work in physics (or related fields) with an average grade of at least B. Eighteen of these units must represent graduate courses in physics. Neither upper division courses required in the Physics Major Program nor PHYSICS 290 seminars, PHYSICS 295, PHYSICS 299, PHYSICS 301, or PHYSICS 602 may be used to satisfy the 35 unit requirement. No more than one-third of the 16 elective units may be fulfilled by courses graded Satisfactory, and then only if approved by the head graduate adviser.

3) Pass a comprehensive examination (passing the preliminary examinations constitutes passing the comprehensive exam).

Normative Time Requirements

See the Physics Department's website (http://physics.berkeley.edu/academics/graduate-degrees/phd-program/) for expected progress towards a PhD in Physics.

Time to Advancement

Curriculum

Courses Required

PHYSICS 209	Classical Electromagnetism	5
PHYSICS 211	Equilibrium Statistical Physics	4
PHYSICS 221A	Quantum Mechanics	5
PHYSICS 221B	Quantum Mechanics	5
Physics electives:		
Graduate		11
Graduate/Upper Division		8

Graduate students are required to take a minimum of 38 units of approved upper division or graduate elective courses (excluding any upper division courses required for the undergraduate major). The department requires that students take the following courses which total 19 units: Physics 209 (Classical Electromagnetism), Physics 211 (Equilibrium Statistical Physics) and Physics 221A-221B (Quantum Mechanics). Thus, the normative program includes an additional 19 units (five semester courses) of approved upper division or graduate elective courses. At least 11 units must be in the 200 series courses. Some of the 19 elective units could include courses in mathematics, biophysics, astrophysics, or from other science and engineering departments. Physics 290, 295, 299, 301, and 602 are excluded from the 19 elective units. Physics 209, 211 and 221A-221B must be completed for a letter grade (with a minimum average grade of B). No more than one-third of the 19 elective units may be fulfilled by courses graded Satisfactory, and then only with the approval of the Department. Entering students are required to enroll in Physics 209 and 221A in the fall semester of their first year and Physics 211 and 221B in the spring semester of their first year. Exceptions to this requirement are made for 1) students who do not have sufficient background to enroll in these courses and have a written recommendation from their faculty mentor and approval from the head graduate adviser to delay enrollment to take preparatory classes, 2) students who have taken the equivalent of these courses elsewhere and receive written approval from the Department to be exempted.

If a student has taken courses equivalent to Physics 209, 211 or 221A-221B, then subject credit may be granted for each of these course requirements. A faculty committee will review your course syllabi and transcript. A waiver form can be obtained from the Physics Student Affairs Officer detailing all required documents. If the committee agrees that the student has satisfied the course requirement at another institution, the student must secure the Head Graduate Adviser's approval. The student must also take and pass the associated section of the preliminary exam. Please note that official course waiver approval will not be granted until after the preliminary exam results have been announced. If course waivers are approved, units for the waived required courses do not have to be replaced for PhD course requirements. If a student has satisfied all first-year required graduate courses elsewhere, they are only required to take an additional 19 units to satisfy remaining PhD course requirements. (Note that units for required courses must be replaced for MA degree course requirements even if the courses

themselves are waived; for more information please see MA degree requirements).

In exceptional cases, students transferring from other graduate programs may request a partial waiver of the 19 elective unit requirement. Such requests must be made at the time of application for admission to the Department.

Preliminary Examination

The preliminary examination is a written examination and is designed to ensure that students command a broad spectrum of undergraduate physics prior to engaging in graduate research. The written exam is composed of four sections, and all four sections of the preliminary exam are offered at the beginning of both fall and spring semesters. Additional information can be found on our website (http://physics.berkeley.edu/sites/default/files/_/prelim_policy.pdf).

Qualifying Examination

After the beginning of research and no later than the completion of four semesters of research, the student is expected to take an oral qualifying examination covering his or her research field and related areas. The examination is administered by a four-member committee (consisting of three physics faculty members and one Academic Senate Representative) approved by the Graduate Division.

Further details can be found on our website (http://physics.berkeley.edu/sites/default/files/_/qualifying_exam_infosheet.pdf).

Physics

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

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 2022, Spring 2021, Spring 2020
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 2022, Spring 2021, Spring 2019
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 2021, Fall 2020, Fall 2019
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 2021, Fall 2020, Fall 2019
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 2022, Spring 2021, Spring 2020
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 2021, Fall 2020, Fall 2019
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 2022, Spring 2021, Spring 2020
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: Spring 2022, Spring 2021
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 2021, Fall 2020, Fall 2019
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 2022, Spring 2021, Spring 2020
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 2021, Fall 2020, Fall 2019
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: Spring 2021, Fall 2016, Fall 2015
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 2021, Spring 2019, Spring 2017
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 2022, Spring 2021, Spring 2020
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 2021, Fall 2020, Fall 2019
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 2022, Spring 2021, Spring 2020
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 2022, Spring 2021, Spring 2020
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 2021, Fall 2020, Fall 2019
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 2021, Fall 2020, Fall 2019
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 2021, Spring 2020, Spring 2019
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 2021, Fall 2020, Fall 2019
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 2021, Fall 2020, Fall 2019
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 2022, Spring 2021, Spring 2020
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 2021, Fall 2019, Fall 2017
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 2021, Fall 2019, Spring 2019
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 2021, Fall 2020, Fall 2019
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: Spring 2022, 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: Spring 2022, 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 2021, 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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021, Fall 2020, Spring 2020
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 2021, Fall 2015, Fall 2014
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: Spring 2022, Fall 2021, Spring 2021
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: Spring 2022, Fall 2021, Spring 2021
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 2021, Fall 2020, Fall 2019
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 [-]