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 Program

Applying for Graduate Admission

Thank you for considering UC Berkeley for graduate study! UC Berkeley offers more than 120 graduate programs representing the breadth and depth of interdisciplinary scholarship. A complete list of graduate academic departments, degrees offered, and application deadlines can be found on the Graduate Division website (http://grad.berkeley.edu/programs/list/).

Prospective students must submit an online application to be considered for admission, in addition to any supplemental materials specific to the program for which they are applying. The online application can be found on the Graduate Division website (http://grad.berkeley.edu/admissions/).

Admission Requirements

The minimum graduate admission requirements are:

1. A bachelor’s degree or recognized equivalent from an accredited institution;
2. A satisfactory scholastic average, usually a minimum grade-point average (GPA) of 3.0 (B) on a 4.0 scale; and
3. Enough undergraduate training to do graduate work in your chosen field.

For a list of requirements to complete your graduate application, please see the Graduate Division’s Admissions Requirements page (https://grad.berkeley.edu/admissions/steps-to-apply/requirements/). It is also important to check with the program or department of interest, as they may have additional requirements specific to their program of study and degree. Department contact information can be found here (http://guide.berkeley.edu/graduate/degree-programs/).

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, test scores, 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 coursework 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 209</td>
<td>Classical Electromagnetism</td>
<td>5</td>
</tr>
<tr>
<td>PHYSICS 211</td>
<td>Equilibrium Statistical Physics</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 221A</td>
<td>Quantum Mechanics</td>
<td>5</td>
</tr>
<tr>
<td>PHYSICS 221B</td>
<td>Quantum Mechanics</td>
<td>5</td>
</tr>
</tbody>
</table>

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 Physics preliminary examination constitutes passing the comprehensive exam).
Normative Time Requirements

The normative time for completing a PhD in Physics is six years.

Time to Advancement

Curriculum

Courses Required

<table>
<thead>
<tr>
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<td>Quantum Mechanics</td>
<td>5</td>
</tr>
</tbody>
</table>

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.

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 designed to ensure that students command a broad spectrum of undergraduate physics prior to their engaging in graduate research. The preliminary exam is a written exam composed of four sections, grouped by general subject areas of undergraduate physics. All four sections of the preliminary examination are offered at the beginning of both Fall and Spring semesters. A student who has passed all four sections of the exam will have passed the preliminary examination. The Department expects students to pass the examination within the first three semesters of graduate study (see further notes on this below).

The preliminary exam is intended as one tool for helping the Department evaluate that students are making adequate progress towards their PhD. The determination of a student's academic standing in the Department will be based on a student's entire record, including performance on the prelim exam, undergraduate coursework, graduate coursework, and research performance where appropriate. Consequently, a student would not be asked to leave the Department based solely on performance on the written preliminary exam.

The written exam has four sections, covering (1) classical mechanics, (2) electromagnetism and optics, and special relativity, (3) thermodynamics and statistical physics, and (4) quantum mechanics. Note that these divisions do not preclude the possibility of questions on one section that draw from subject matter emphasized in a different section. (For example, a question that touches on thermodynamics in the quantum mechanics section.) A student who passes any section of the written exam need not take that section again. Each section lasts three hours and covers traditional, textbook style problems, as well as more comprehensive questions that specifically test physical and numerical insight (e.g. order-of-magnitude estimates including physical constants, analyzing physical situations by application of general principles instead of complex calculations, etc.). A student's individual performance on each section of the exam, and not ranking relative to other students, will determine whether that student has passed or failed the section. In other words, there is no predetermined percentage of students to pass/fail the exam.

Students are encouraged, but not required, to attempt the examination during their first semester. Students are required to have attempted all of the written sections in their second semester. The status of students who have not yet passed all sections of the preliminary examination will be reviewed by a faculty committee each semester, beginning in the student's third semester, and recommendations of further action will be made. The Department Chair must approve exceptions to this schedule; all exceptions, except those due to illness or emergency, must be approved in advance.

The academic record of a student in their third semester who has not passed all four written sections will be reviewed. Near the beginning of the third semester (as prelim exam results become available) a faculty committee, in consultation with the student's faculty mentor, will review the student's academic record and performance on the prelims to determine whether a sufficient breadth of undergraduate physics has been demonstrated. This review may include meeting with the student to ask questions to further assess the student's understanding of undergraduate physics, focusing primarily although not exclusively on the not-yet-passed sections of the exam, to discuss the student's background and how best to address remaining deficiencies. If their determination is that the student has a sufficient breadth of undergraduate physics, the
student will be determined to have passed the prelim exam, and will be
allowed to proceed with research. If the committee’s determination is that
this understanding is not yet demonstrated, they will recommend that the
student be sent a warning letter by the Department Chair, and will specify
requirements (including a timeline) for the student to return to making
sufficient academic progress. These requirements could include taking
and passing with a B or better grade specific undergraduate courses
during the third and/or fourth semester, and/or retaking and passing
sections of the prelim exam not yet passed at the start of the fourth
semester. This review could also result in additional recommendations
to the student, such as serving as GSI for a course deemed appropriate
to reinforce previous undergraduate coursework. The intent of this third-
semester review by the faculty committee is to determine if deficiencies
exist in a student’s knowledge of undergraduate physics, and if so, what
actions are required of the student to address these deficiencies.

A faculty committee will then review the student’s efforts towards
returning to good academic progress at the beginning of the fourth
semester. This 4th semester review may also include meeting with
the student to ask questions to assess the student’s understanding of
undergraduate physics. This faculty committee will review the student’s
entire academic record — including performance on the preliminary
exam, coursework, and intended research plans — and recommend to
the Department Chair whether the student is making sufficient academic
progress and may be allowed to proceed with research. The Head
Graduate Adviser or Department Chair will report the results to the
Graduate Division. If requirements established in the 3rd semester
review include undergraduate courses taken in the fourth semester, this
4th semester review can be deferred until the grades in these courses are
determined, but in no case can this review be extended past the end of
the student’s 4th semester. This review is not intended to create
additional requirements, but to determine if previous requirements have
been met, and in particular should not require any further attempts at
passing any section of the preliminary exam. The intent of this fourth-
semester review by the faculty committee is to determine whether a
student has mastered sufficient undergraduate physics to start PhD level
research by the end of the 2nd year. If the committee concludes that such
mastery is not present, they will recommend to the Department Chair that
the student be asked to leave the program due to inadequate progress
towards the PhD.

A revision in this schedule can be granted, for one or more sections of
the preliminary exam, for any student with an incomplete undergraduate
physics education as determined by consultation between the student
and the student’s faculty mentor. Both the Head Graduate Advisor and
the Department Chair must approve this revised schedule. Any student
exercising this option is expected to take one or more undergraduate
physics courses at UC Berkeley during the first one or two semesters.
This student should follow the regular schedule outlined above for any
sections of the exam not affected by the revised schedule, and is allowed
to attempt the delayed section(s) at the start of their first one or two
semesters for practice, in which case the student would not be required
to repeat any sections that have been passed during this period. The
student would then be expected to take all sections of the exam not yet
passed at the beginning of the 3rd semester, and to repeat any unpassed
sections at the start of the 4th semester. A faculty committee will be
asked to assess this student following this exam if there are still sections
not passed, following guidelines above, and can either determine that
the student has demonstrated a sufficient breadth of undergraduate
physics, and hence has passed the prelim exam, or to recommend that
the student be sent a warning letter with specific requirements and a
timeline for being returned to making sufficient academic progress; the
most likely requirement and timeline for this is to be asked to study over
the following summer and to attempt the still unpassed sections a final
time at the start of the 5th semester. The intent of this 4th and potentially
5th semester review by the faculty committee is that a student shall either
determine to have mastered sufficient undergraduate physics to
start PhD level research by the start of their 3rd year, or else be asked to
leave the program due to inadequate progress towards the PhD. Delays
in this decision beyond the start of the 3rd year are highly discouraged
and will only be considered under exceptional circumstances.

Qualifying Examination

Within 2-3 semesters of beginning research, the Department expects
students to take the University’s Oral Qualifying Examination covering
his or her research field and related areas. This exam is required
for advancement to PhD candidacy, and signifies that the student is
prepared and qualified to undertake research, not that the student has
already completed a significant body of work towards the PhD. It is
therefore expected to occur for most students in the 3rd year, and no
later than the 4th year. A student is considered to have begun research
when they first register for Physics 299 or fill out the department advising
form showing that a research advisor has accepted the student for
PhD work, at which time the research advisor becomes responsible for
guidance and mentoring of the student. The examination is administered
by a four-member committee (consisting of three Physics Department
and one outside faculty member, including the research advisor) approved
by the Graduate Division on behalf of the Graduate Council,
and may be repeated once at the recommendation of the examining
committee. The Department expects that all committees include at least
one theorist and one experimentalist. For students with advisors from
outside the department or who are not members of the Academic Senate
(e.g., with appointments at LBNL or SSL), permission for a five-member
committee may be requested from Grad Division to allow both the non-
faculty and faculty advisor to be on the committee; in this case, approval
of the proposed research by the Head Graduate Advisor and the Chair
of the Department must also be obtained before the student takes their
qualifying exam.

Rules and requirements associated with the Qualifying Exam are set by
the Graduate Division on behalf of the Graduate Council. The committee
membership and the conduct of the exam are therefore subject to
Graduate Division approval. The exam is oral and lasts 2-3 hours. The
Graduate Division specifies that the purpose of the Qualifying Exam is
“to ascertain the breadth of the student’s comprehension of fundamental
facts and principles that apply to at least three subjects areas related to
the major field of study and whether the student has the ability to think
incisively and critically about the theoretical and the practical aspects
of these areas.” Grad Division also states that this oral qualifying exam
serves a significant additional function. “Not only teaching, but the formal
interaction with one’s students and colleagues at colloquia, annual
meetings of professional societies and the like, often require the ability
to synthesize rapidly, organize clearly, and argue cogently in an oral
setting.... It is consequently necessary for the University to ensure that a
proper examination is given incorporating [these skills].”

The Qualifying Exam requires that the student, in consultation with his
or her advisor, identify three topics which in the Physics Department
are expected to be a proposed Thesis Topic, an Area of Research,
and a General Area of Research. The General Area of Research is
taken to be the sub-field within physics (e.g. astrophysics, biophysics,
particle physics, condensed matter physics); the Area of Research to
be a still broad but more narrowly defined field within the sub-field (e.g.
magnetism, or QCD). For fields where these choices are not obvious,
the student should suggest appropriately broad topics contiguous to their Thesis Topic. The choice of topics is subject to the approval of the Physics Department Head Graduate Adviser, per Graduate Council Requirements. Qualifying Exams in the Physics Department begin with a presentation from the student that is expected to last approximately, but no more than, 45 minutes, during and after which questions related to the presentation are typically asked. The presentation should focus on the student's research goals and necessary background material, including the proposed Thesis Topic and the Area of Research that encompasses the thesis topic, as well as a proposed schedule for finishing the PhD and goals/milestones in that schedule. After this presentation, following a short break if desired, members of the committee will further question the student both about the presentation itself and about the broader subject areas included in the General Area of Research, testing the student’s “ability to think incisively and critically about the theoretical and the practical aspects of these areas”. The Department expects these questions to be related to the student's research field, but to be broad in nature rather than narrowly related to the thesis itself. Ability to give a coherent and organized presentation and to answer questions on the three topics in an oral setting is also required for passing this exam. Note that adjustments may be made on the basis of campus policies for cases in which an otherwise able individual is prevented from meeting an oral requirement by a physical disability.

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

PHYSICS C202 Astrophysical Fluid Dynamics 4 Units
Terms offered: Fall 2023, Spring 2023, Spring 2022
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

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.

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.

Instructors: Gronsky, S.W. Lee, Wu

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 2024, Spring 2023, Spring 2020
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 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 C207 Radiation Processes in Astronomy 4 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021
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:

Also listed as:

Radiation Processes in Astronomy: Read Less [-]

PHYSICS 209 Classical Electromagnetism 5 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021

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 2024, Spring 2023, Spring 2022

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 2023, Fall 2022, Fall 2021

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 2024, Spring 2023, Spring 2022
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: Fall 2023, Spring 2023, Spring 2022
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 2023, Fall 2022, Fall 2021
Basic assumptions of quantum mechanics; quantum theory of measurement; matrix mechanics; Schrödinger 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 2024, Spring 2023, Spring 2022
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 2023, Fall 2022, Fall 2021
Introduction to particle physics phenomena. Emphasis is placed on experimental tests of particle physics models. Topics include Quark model spectroscopy; weak decays; overview of detectors and accelerators; e+e- annihilation; parton model; electron-proton and neutrino-proton scattering; special topics of current interest.
Particle Physics Phenomenology: Read More [+]

Rules & Requirements
Prerequisites: 221A-221B or equivalent or consent of instructor

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

Additional Details
Subject/Course Level: Physics/Graduate
Grading: Letter grade.

Particle Physics Phenomenology: Read Less [-]

PHYSICS C228 Extragalactic Astronomy and Cosmology 3 Units
Terms offered: Fall 2022, Spring 2021, Fall 2016
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 2023, Spring 2021, Spring 2019
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

Advanced Cosmology: Read Less [-]

PHYSICS 230 Quantum and Nonlinear Optics 3 Units
Terms offered: Spring 2024
The detailed theory and experimental basis of quantum and nonlinear optics is presented and used to exhibit basic concepts of quantum measurements and noise, stochastic processes and dissipative quantum systems. Topics covered may include the second-quantization treatment of electromagnetic fields, photodetection, coherence properties of quantum-optical fields, light-atom interactions, cavity quantum electrodynamics, several non-linear optical systems, squeezed light and its applications, aspects of quantum information science, and selected topics at the forefront of modern optics research.
Quantum and Nonlinear Optics: Read More [+]
Rules & Requirements
Prerequisites: Physics 110A, Physics 137A, Physics 137B, or consent of instructor

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

Quantum and Nonlinear Optics: Read Less [-]

PHYSICS 231 General Relativity 4 Units
Terms offered: Spring 2024, Spring 2023, Spring 2022
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 2023, Fall 2022, Fall 2021
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 2024, Spring 2023, Spring 2022
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 2024, Spring 2023, Spring 2022
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 2023, Fall 2021, Fall 2020
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 phenomenology;
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 2024, Spring 2023, Spring 2021
Nonperturbative aspects 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 238B Advanced Atomic, Molecular, and Optical Physics 4 Units
Terms offered: Fall 2023
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: Physics 110A; Physics 137A; Physics 137B; Physics 130 or 230; Physics 138 or 238A
Credit Restrictions: Students will receive no credit for PHYSICS 238B after completing PHYSICS 238. A deficient grade in PHYSICS 238B may be removed by taking PHYSICS 238.

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 238A Modern Atomic Physics 3 Units
Terms offered: Spring 2023
Atomic, molecular, and optical physics is at once a precise and quantitative description of atoms, molecules and light; a generalized toolbox for manipulating and probing quantum systems; and an active field of contemporary research. This course exposes students to all these aspects. Lectures will cover topics such as atomic structure and spectra, the interaction of atoms with static and time-varying electromagnetic fields, some topics in quantum electrodynamics, methods of resonant manipulation of quantum systems, and resonance optics. Through lectures, discussion sessions, and homework assignments, students encounter contemporary research foci.
Modern Atomic Physics: Read More [+]

Rules & Requirements
Prerequisites: Physics 110A, Physics 137A, Physics 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/Graduate
Grading: Letter grade.

Modern Atomic Physics: Read Less [-]

PHYSICS 240A Quantum Theory of Solids 4 Units
Terms offered: Fall 2023, Fall 2022, Fall 2021
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 2024, Spring 2023, Spring 2022
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 242B Theoretical Plasma Physics 4 Units**

Terms offered: Spring 2024, Spring 2020, Spring 2016
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 242A Theoretical Plasma Physics 4 Units**

Terms offered: Fall 2023, Fall 2021, Fall 2019
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: Spring 2024, Fall 2021, Fall 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 2023, Fall 2022, Fall 2021
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 2024, Spring 2023, Spring 2022, Fall 2018
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 2024, Fall 2023, Spring 2023, Fall 2022, Fall 2019
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 2023, Fall 2022, Fall 2021
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 2024, Fall 2023, Spring 2023
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 2024, Fall 2023, Spring 2023
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 290C 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 290D 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
Seminars: 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.
Seminars: Read Less [-]

PHYSICS 290I Seminar 2 Units
Seminars: 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.
Seminars: Read Less [-]

PHYSICS 290J Seminar 2 Units
Terms offered: Prior to 2007
Seminars: 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.
Seminars: Read Less [-]

PHYSICS 290K Seminar 2 Units
Terms offered: Spring 2024, Fall 2023, Spring 2023
Seminars: 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.
Seminars: Read Less [-]

PHYSICS 290L Seminar 2 Units
Terms offered: Fall 2012, Fall 2000
Seminars: 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.
Seminars: Read Less [-]

PHYSICS 290N Seminar in Non-Neutral Plasmas 2 Units
Terms offered: Spring 2007, Fall 2006, Spring 2006
Seminars 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.
Seminars in Non-Neutral Plasmas: Read Less [-]
PHYSICS 290P Seminar 2 Units
Terms offered: Spring 2024, Fall 2023, Spring 2023
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 2024, Fall 2023, Spring 2023
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 2024, Fall 2023, Spring 2023
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 2024, Fall 2023, Spring 2023, Spring 2022
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
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.

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 2024, Fall 2023, Spring 2023
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 2024, Fall 2023, Spring 2023
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 305 Professional Preparation: Supervised Teaching of Physics 2 Units
Terms offered: Fall 2021, Fall 2020, Fall 19
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 375 Professional Preparation: Supervised Teaching of Physics 2 Units
Terms offered: Fall 2021, Fall 2020, Fall 19
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.
Professional Preparation: Supervised Teaching of Physics: 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 [-]