

Physics Graduate Ph.D. program under quarters

General Information

The program for the Ph.D. degree must lead to mastery at a high level of the fundamental principles of physics and mathematics necessary for productive and creative scholarship in physics. The program is planned by the student and a member of the Graduate Faculty who acts as her/his research advisor so as to meet the student's individual needs and interests. Important aspects of the program include:

Course requirements: The “core course requirement” and “advanced course requirement” are described below.

Research Advisor: The student is encouraged to have chosen a research area of interest within the first year and should choose a research advisor who will serve to guide the student through her/his research project prior to the annual review of the second year. To encourage and facilitate this selection process, all first and second year physics graduate students must find a research advisor (temporary or permanent) and register for at least three credit hours of Physics 816 (Topics in Physics – independent study) or Physics 999 (thesis research) during at least one quarter each academic year. This does not commit the student or advisor to on-going Ph.D. research. First year students typically register for this research during Spring Quarter, prior to the Summer Quarter “Fourth Quarter Research GRA” appointment, which is awarded to all first and second year regular Ph.D. students who are in good standing with the department. The required student time commitment for this research is at the discretion of the research advisor, and should take into account the student’s coursework and teaching loads. At a minimum, it should include attending group meetings and reading pertinent literature.

Advisory Committee: Upon satisfying the “core course requirement” and completing at least two of the five required “advanced courses” (see below), the student and the research advisor will select an Advisory Committee consisting of the research advisor, a theorist and an experimentalist within the area of specialization of the advisor, and a fourth member of the graduate physics faculty from outside of the advisor’s research area. This Advisory Committee will conduct the annual review for the student throughout the research program. It shall also serve as the Candidacy Exam Committee and (together with the Graduate School Representative) the Dissertation Committee (see below). If any member of the Advisory Committee is unable to fulfill any one of these functions within a reasonable time frame (e.g., because of sabbatical leave or extensive travel), a substitute may be petitioned by the submission of a letter from the student and the advisor to the Graduate Studies Office substantiating the need for a replacement.

Candidacy Examination: The Candidacy Examination is described below.

Annual Review: The Graduate Studies Committee of the department will review the performance of all graduate students annually as discussed below.

Dissertation and Final Oral Examination: The candidate must submit a satisfactory dissertation and pass a Final Oral Examination in order to qualify for the Ph.D. The Final Oral Examination is described below.

Graduate School: The student must fulfill all of the Graduate School requirements. The current requirements and the order in which they must be fulfilled are listed in the Graduate School Handbook.

Foreign language: The Department of Physics does not require a demonstration of competency in a foreign language as a part of the Ph.D. requirement.

Language Requirements: All international students who are not citizens of countries in which English is the official language are required by the Physics Department to be certified in spoken English prior to the end of the third quarter of study, not including Summer Quarter. In addition, the Graduate School requires that English 108.02 (a writing course) or its equivalent be completed within four quarters of entering graduate school.

Academic Requirements

General Requirements: As mentioned above, each student is expected to attain a high level of proficiency in the fundamentals of physics and to acquire a broad education in the principal areas of his/her physics research.

The courses in the curriculum fall into three categories:

- a set of core courses intended to develop the fundamentals of the field,
- a set of advanced courses intended to develop the essentials of the various specialized areas of contemporary physics.

In addition to the formal course requirements, all graduate students in physics are expected to attend the weekly departmental colloquia and seminars on a regular basis.

It is strongly recommended that each student have some teaching experience as part of his or her graduate program.

Each student is expected to begin research as early as possible and should endeavor to decide on an area of specialization during the first year of study and a research advisor prior to the annual review for the second year. In any case the choice of research advisor should be made by the beginning of the third year.

Each student will be expected to proceed to the Ph. D. degree as quickly as is possible under her/his personal circumstances.

Departmental course requirements:

Core Course Requirement:

Except in the special case given below, all graduate students enrolled in the Physics Ph.D. program must take the core courses 827-828-829, 834-835-836, 846-847, and 821 (which are defined as the four sets of courses), at least five advanced courses, and pass the Candidacy Exam within the first three years of entering the program and attain a minimum GPA of B+ (3.30) in the core courses. If a student receives a low grade in any of the core courses, she/he may retake that course only once with the higher score being used to calculate the GPA. If this minimum GPA requirement is not met within the first three years of entering, the student is disqualified from the Ph.D. program.

***Special case--Students entering with a Physics GRE score of 750 or higher and with evidence from their official transcripts that they have successfully taken equivalent graduate courses at their previous institute may request to test out of one or more of the four sets of courses as appropriate to the equivalent courses taken. Exceptions to the 750 score requirement will be considered by petition to the Graduate Studies Committee. The method used for testing out of a course set is at the discretion of the Vice Chair for Graduate Studies and Research.

Advanced Course Requirement:

The advanced graduate course requirement for a Ph.D. is five courses total. The 800-level courses must be chosen from the list of "Advanced Courses" (see below), which are 830, 848, 880.02, 880.05, 880.06, 880.08, and 880.20, and no more than two 780 courses can be used for this requirement (i.e. five 800, four 800 + one 780, and three 800 + two 780 all meet the requirement). Except for those given above, there are no other restrictions on which courses may be taken to satisfy this requirement.

Note that students are encouraged to complete the core course requirements and enough of the advanced course requirement in order and pass the Candidacy Exam before the beginning of their third year. Ph.D. Graduate students are required to complete all course requirements and pass the Candidacy Exam before the beginning of their fourth year.

Core Courses - These courses provide the foundations of the physics program.

P821	Advanced Dynamics
P827-828-829	Quantum Mechanics
P834-835-836	Electromagnetic Field Theory
P846-847	Thermodynamics and Statistical Mechanics

Contemporary Physics Courses (P780 level) - These courses provide a general overview of their respective research fields. Note that 780 courses are required to be taught at an introductory level such that senior undergraduates are qualified to take them.

P780.02	Physics of Elementary Particles
P780.04	Physics of Atoms and Molecules
P780.05	Physics of Nuclei
P780.06	Physics of Condensed Matter
P780.20	Special topics, including Physics Education, Biophysics, Computational Physics, Atomic and Laser Spectroscopy, etc.

In addition, other courses in contemporary physics at the 780 level are offered from time to time. A list of these courses is given online. Courses may be taught only when an adequate number of students enroll for credit in the course.

In order to become familiar with and get involved with the research programs in the department, students are required to enroll in the Seminar "Topics in Physics," Physics 795, during Autumn and Winter Quarters of their first year, and to register for at least three credit hours of 816 (Topics in Physics – independent study) or 999 (thesis research) during at least one quarter during their first and second years. Graduate students who are Graduate Teaching Associates are also required to be enrolled in the Physics 801A seminar in any quarter (excluding summer) during the first year that they are teaching.

Advanced Courses - Several courses which are advanced extensions of the core course sequences are offered on a regular basis given sufficient demand by the students. These include:

P830	Advanced/Many-body quantum theory (one quarter)
P848	Advanced Statistical Physics (one quarter)
P880.02	Elementary Particle Physics (three quarters)
P880.05	Nuclear Physics (three quarters)
P880.06	Condensed Matter Physics (three quarters)
P880.08	Field Theory (three quarters)
P880.20	Special Topics, including Atomic, Molecular and Optical Physics, Non-linear Physics, Group Theory, Spectroscopy, General Relativity, Physics Education, Cosmology, Particles and the Early Universe, Nuclear Astrophysics, etc.

The “Special Topics” advanced courses are offered on an irregular basis.

With the approval of her/his Advisory Committee, a student may **substitute** two courses from any other department for two in Physics in satisfying the advanced course requirement.

Colloquia and Seminars - Colloquia and special seminars provide an important opportunity for the faculty and students in the department to be introduced to research programs underway in the

department as well as to hear reports from scientists from throughout the U.S. and other parts of the world. Attendance at the weekly departmental colloquia on a regular basis is expected of all graduate students. For students who have selected an area in which to do their research, or are in the process of making such a choice, attendance at the special seminars in that area provides an important means of becoming acquainted with the frontiers of the field. All students are strongly advised to attend the special seminars in their chosen research area.