Rationale for Changes to the Ph.D. Program from quarters to semesters

Overall, there are minimal changes in course content requirements, but there are some changes in how and when graduate students will take required courses. The main changes are:

(1) The content of the three-quarter Electromagnetic Field Theory core-course sequence was split into two parts: one which focuses on the analytical and computation techniques necessary understand and apply the fundamental content of Electromagnetic Field theory, and one which contains the main physics content of the previous sequence. The separated analytical and computation techniques will be combined with other techniques necessary for the other core courses, and put into a one semester course P7701 (Analytic and Numeric Methods of Physics). This course is similar to the old quarter-based course P730 (Methods of Theoretical Physics), but has expanded content and will be taught at a more advanced level. The main physics content of the old Electromagnetic Field Theory sequence will be put into a one-semester course P7401 with the same name.

(2) All of the core courses will be reduced to 3 CR courses (from 5 CR for the old Quantum Mechanics sequence and 4 CR for the other core courses), with some of the less foundational content removed. Under semesters, all graduate students will be required to take all six semester core courses during their first year (exceptions will be considered by petition), so that they will be better positioned to move into research and take advanced courses during their second year. The number of CR and contact hours for each core course was reduced to make it possible for first-year Graduate Teaching Associates to complete all core courses, take the required P6780 and P7891A seminars, fulfill their teaching duties, and to start to get involved in research.

Physics Graduate Ph.D. program under semesters

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 two credit hours of Physics 7998 (Graduate Research) or Physics 8999 (Graduate Thesis Research) during at least one semester 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 Semester, prior to the Summer Term "Summer 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 three 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 second semester of study, not including Summer Term. In addition, the Graduate School requires that English XXXX (a writing course) or its equivalent be completed within one year 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 six core courses 7401, 7501, 7502, 7601, 7602, and 7701, at least three 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 three (non-core) courses total at the 6800-level or above. The 8000 -level courses must be chosen from the list of "Advanced Courses" (see below), which are 8301, 8802.1, 8802.2, 8803.1, 8803.2, 8804.1, 8804.2, 8805.1, 8805.2, 8806.1, 8806.2, 8808.1, 8808.2, 8809.1, and 8809.2, and no more than one 6800-level courses can be used for this requirement (i.e. three 8000, or two 8000 + one 6800, both 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.

P7401	Electromagnetic Field Theory
P7501-7502	Quantum Mechanics 1 - 2
P7601-7602	Classical and Statistical Physics 1 - 2
P7701	Analytic and Numeric methods of Physics

Contemporary Physics Courses (P6800 level) - These courses provide a general overview of their respective research fields. Note that 6800-leval courses are taught at an introductory level such that qualified senior undergraduates are able to take them.

P6802	Topics in Elementary Particle Physics
P6803	Topics in Astroparticle Physics
P6804	Topics in Atomic and Molecular Physics
P6805	Topics in Nuclear Physics
P6806	Topics in Condensed Matter Physics
P6809	Topics in Biophysics
P6810	Topics in Condensed Matter Physics
P6820	Special topics, including Physics Education Research, Physics of Semiconductors, Surface Science, General Relativity, etc.

In addition, other courses in contemporary physics at the 6800 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 " Special Topics Seminar," Physics 6780, during Autumn and Spring Semesters of their first year, and to register for at least two credit hours of Physics 7998 (Graduate Research) or Physics 8999 (Graduate Thesis Research) during at least one semester each academic year during their first two years.

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:

P8301	Elasticity and Fluid Mechanics
P8802.1, P8802.2	Topics in Elementary Particle Physics 1 - 2
P8803.1, P8803.2	Topics in Astroparticle Physics 1 - 2
P8804.1, P8804.2	Topics in Atomic and Molecular Physics 1 - 2
P8805.1, P8805.2	Topics in Nuclear Physics 1 - 2
P8806.1, P8806.2	Topics in Condensed Matter Physics 1 - 2
P8808.1, P8808.2	Topics in the theory of Quantized Fields 1 - 2
P8809.1, P8809.2	Topics in Biophysics 1 - 2
P8820	Special topics, including Non-linear Physics, Group Theory, Spectroscopy, General Relativity, Cosmology, Nuclear Astrophysics, Physics Education Research, Advanced Computational Physics, etc.

The “Special Topics” and some of the other advanced courses are offered on an irregular basis.

With the approval of her/his Advisory Committee, a student may **substitute** one course from any other department for one 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.