

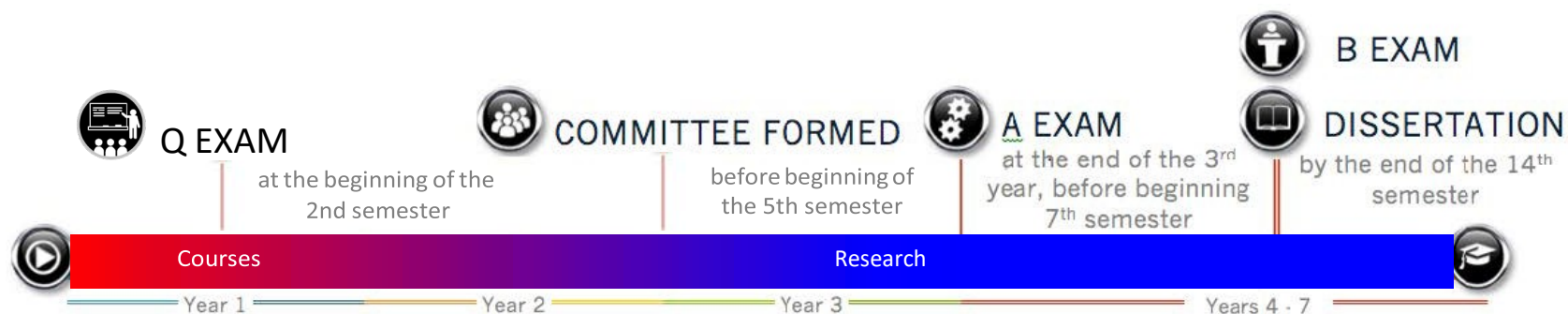
YELLOW BOOK: GUIDE TO GRADUATE STUDY IN PHYSICS



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Edited by Maxim Perelstein and Kacey Acquilano June 2019

Physics PhD Milestones



| | Q Exam | Permanent Committee | A Exam | B Exam | Dissertation |
|--------------------|---|--|---|--|--|
| DESCRIPTION | Oral examination on undergraduate physics | Three member committee consisting of chair and two minor members | Examination in chosen research area | Oral defense of dissertation | Requirement of Ph.D. degree |
| DEADLINE | At the beginning of the 2nd semester | Before beginning of the 5th semester (end of 2nd year) | Before beginning of 7th semester (end of 3rd year) | <ul style="list-style-type: none"> By 14th semester (no more than 7 years) Minimum of 6 registered semesters At least 2 semesters between A & B exam | By 14th semester (no more than 7 years) |

I. Program at a Glance

The program is designed for the student who wants to become a professional physicist. It has two main ingredients: (a) mastery of at least a core of advanced general physics, and (b) original research in a specific area of physics. The core mastery component is intended to provide the students with the foundational knowledge enabling them to pursue a broad range of employment options upon graduation, including teaching physics at a four-year college level or higher, and/or conducting research in areas different than that of the thesis. The research component provides the student with an in-depth knowledge of a particular area of active physics research, along with significant research experience in that area culminating in production of a thesis based on original scientific findings.

The student's progress through the program is punctuated by a number of "milestones", which are summarized in the chart on the left and explained in detail later in this document. The deadlines for each milestone are based on the length of time spent in the program. All deadlines are automatically extended by one semester for each semester spent on Personal or Health Leave (see section VII).

Most students begin the program by taking Core Courses (see Section II), while also being funded as teaching assistants (see Section VI). The advising seminar, PHYS 7685, is offered in the fall semester to help new students integrate into the program and learn about physics research at Cornell. The Qualifying exam (see Section III) is taken at the beginning of the student's 2nd semester at Cornell. Students should start actively looking for a research group in their first year, and should plan on spending the summer after the first year on campus, either doing research full-time or pursuing reading projects directed by a faculty member. Second-year students generally split their time between taking advanced courses relevant to their chosen research field, and doing research. The time spent on each activity may vary widely depending on the area of specialization. By the end of the second year, the student should identify the faculty member who will supervise the thesis, i.e. serve as the Ph.D. advisor. The mutual commitment between the student and the advisor is formalized by the formation of the permanent special committee (see Section IV). From that point on, the student's efforts are primarily directed towards research, and the thesis advisor serves as the main source of guidance. The A exam (Admission to Candidacy) is taken in the third year, and is devoted to subjects in the area of the proposed thesis topic. After a sufficient body of original research results has been produced, the student prepares a thesis, which is approved by the advisor and the permanent special committee. Finally, the student takes the B exam, also known as "Thesis Defense", and completes the program. The typical time spent in the program is about six years. The Graduate School requires that all students complete their degrees within 7 years of matriculation (not counting leaves of absence).

While this timeline is typical, there is quite a bit of flexibility in some areas. For example, students who have completed some graduate-level coursework prior to starting the program may

be able to accelerate transition into research by adjusting the first-year coursework to match their preparation (see Section II).

Throughout the program, the student is guided by a special committee, consisting of three or more faculty members. Each entering student is assigned by the field a temporary special committee. It is eventually replaced by the permanent special committee selected by the student, chaired by the thesis advisor. In addition to providing guidance and advice, the special committees administer A and B exams. The special committee chair is also responsible for completing an annual Student Progress Review (SPR) for each student in the 2nd year and beyond (see Section V). SPRs provide a formal mechanism for annual evaluation of the student's progress towards the Ph.D., and are required by the Graduate School.

II. Course Requirements and Guidelines

The Field of Physics graduate program has one required course, PHYS 6510, Advanced Experimental Physics. This course is offered in both fall and spring semesters every year. It is strongly recommended that PHYS 6510 is taken in the student's first year; this is especially important for students who intend to pursue research in experimental physics. In any event, PHYS 6510 must be completed before the A Exam is taken. No exemptions from the PHYS 6510 requirement will be granted. Students who attended Cornell as undergraduates and completed PHYS 4410 must take PHYS 6510, but may request credit for work completed in 4410. The PHYS 6510 course instructor will decide whether or not such credit is granted.

All Field of Physics graduate students are required to demonstrate mastery of three core areas of advanced physics: Electricity and Magnetism, Quantum Mechanics, and Statistical Physics. The expected mastery is at the level of the Core Courses offered by the Physics Department: PHYS 6561 (Electricity and Magnetism), PHYS 6572 (Quantum Mechanics I), and PHYS 6562 (Statistical Physics I). Mastery may be demonstrated in one of three ways:

- A. Taking and passing the Core Courses. Courses must be taken on a letter grade basis, and a grade of C or above is considered a passing grade.
- B. Showing that, prior to arrival at Cornell, the student has completed course(s) that covered the corresponding area(s) at a level similar to that of Cornell Core Courses. The determination of course equivalency is made by the chair of the temporary special committee upon the student's arrival at Cornell.
- C. In exceptional cases, a student who has acquired the mastery of a core area prior to arrival at Cornell without completing a formal course may establish mastery by taking a written examination in that area.

Most students follow option A and take the Core Courses during their first year in the program. Delaying any of the Core Courses beyond the first year is strongly discouraged, and may be approved by the temporary special committee only if specific and compelling reasons are given. A student wishing to explore options B or C, for one or more of the core areas, should discuss this with the chair of the temporary special committee in their first meeting upon arrival at Cornell. If option B is pursued, the student should provide the committee chair with documentation to help establish course equivalency (syllabus, textbook, assignments, etc.) If option C is pursued, the committee chair will conduct a preliminary discussion with the student to determine whether a written examination is appropriate. If recommended by the committee chair, the written examination will be scheduled prior to or close to the beginning of the student's first semester in the program.

For courses beyond the Core, students should make their course selection in consultation with their (temporary or permanent) special committees. Most of the coursework beyond the Core should be directly relevant to the student's chosen area of research. For a list of courses typically recommended in each research area, see Appendix. It is also recommended that all students should acquire some knowledge outside of their thesis area, by taking a graduate-level course in a different sub-field of physics or a different science/engineering department. Advanced students wishing to take further courses outside of their thesis area should obtain the approval of their research advisor. It is understood that such coursework will not compromise the time and effort spent on thesis research.

For students not engaged in research, the number of regular (3 or 4-credit) courses per semester considered to be full-time is two, if supported as a Teaching Assistant, or three, if supported by a Fellowship. During the transition from coursework to full-time research, the number of courses taken should decrease in concert with the increase in time devoted to research or directed reading. Roughly, students should expect to spend 15-20 hours per week on such activities for each one-course reduction in the course load. The total number of courses to be taken during a graduate career will differ by subfield, but should generally range from 7 to 16 courses.

Professional Development

All first-year students are expected to enroll in PHYS 7685 (Guide to Graduate Research in Physics), in their first semester. PHYS 7685 is a 1-credit professional development seminar which meets once a week, and does not require work outside of the meetings. PHYS 7685 cannot be counted towards the full-time academic schedule requirement (see Section V).

The Graduate School, the Field of Physics and other related fields provide many opportunities for advanced graduate students to continue their professional development through formal courses, workshops, etc. All Physics graduate students are encouraged to take PHYS 7679 (Finding Your Scientific Voice). The field will provide to students timely information regarding this and other professional development opportunities.

All graduate students are expected to attend the weekly physics colloquium, which is held on Mondays at 4 pm. The colloquium committee invites leading experts in various areas of physics, who are asked to make their talks accessible to all physicists regardless of the sub-field.

III. Examination Requirements

Q Exam

The Qualifying Examination (Q exam) is required by the Field of Physics. The Q exam is designed to test the student's mastery of undergraduate physics curriculum. The main purpose of the exam is diagnostic, wherein any gaps in a student's knowledge are identified and remedies suggested.

The Q is an oral examination administered twice a year, on the Friday afternoon of the first week of class in the fall and spring semesters. Each student will have two ½-hour sessions during the afternoon, each administered by two physics faculty members. One session will focus on classical/macroscopic phenomena, such as Classical Mechanics, Electricity and Magnetism, Special Relativity, etc. The other session will focus on quantum or microscopic phenomena, such as Quantum Mechanics and Statistical Mechanics. The material tested is at the level of a typical undergraduate curriculum for physics majors in North American universities, including both introductory and intermediate/advanced physics classes.

All students will take the Qualifying Examination in the spring semester of their first year at the latest.

The outcome of the Q exam is determined by a committee consisting of the examiners, the student's special committee chair, and the DGS, with possible input from other faculty members. While the outcome is primarily determined by the student's performance in the oral exam, other factors (such as performance in Cornell courses or research) may be taken into account. The possible outcomes are:

- A. Pass. The student is encouraged to continue to work towards their Ph.D. If a minor weakness in a specific area is revealed during the Q exam, the student may receive an optional recommendation on how to address it.
- B. Conditional Pass. In this case, the student is asked to fulfill an additional requirement (for example, taking or serving as a TA for a specific course) to address a weakness revealed during the Q exam. Once this requirement is fulfilled, the Q exam is considered passed. The student does not need to retake the exam.

- C. Retake. If significant gaps in undergraduate preparation are revealed, the student will be asked to retake the Q exam. The student will be provided with feedback regarding specific areas of weakness noted by the examiners. The student must retake the Q exam the next time it is offered, unless a leave of absence is taken.
- D. A student may take the Q exam at most three times. If the student has exhausted the three attempts at the Q exam and has not passed, the Q exam committee will meet with the student to discuss and recommend a possible course of action.

A Exam

Every student pursuing a Ph.D. with a major in the Field of Physics must take the Admission to Candidacy exam (ACE or A exam). The goal of the exam is to assess the student's readiness to carry out their thesis research. The A exam may be taken after two semesters in the program are completed, is normally completed in the third year of study, and must be taken before commencing the seventh semester of graduate work. Scheduling of the A exam after this time may only occur in special circumstances and is subject to the approval, via general petition, of the Graduate School. In all cases, the timing of this exam is such that the student should have passed the Q exam and completed all of the Core Courses, or demonstrated the equivalent comprehension (see Section II). In particular, scheduling of the A exam will not be approved by the Field until the PHYS 6510 requirement has been satisfied. If the student is pursuing an outside minor, at least a substantial part of the work for that minor should also be completed. In addition, students taking the A exam should have begun research with the faculty member with whom they expect to carry out their thesis research, and must have formed their permanent special committees (see Section IV).

The student must file a Schedule of A Exam form with the Field and the Graduate School no less than one week before the exam is to take place, but filing the form a month or more before the exam is strongly recommended.

The A exam is administered by the student's permanent special committee. The format of the exam described below is the standard practice in the Field of Physics, but adjustments to this format may be made with the consent of all committee members. In any case, the student and committee members should discuss the parameters of the exam ahead of time, so there is a clear understanding of requirements and expectations.

The student should receive an A exam question from each of the committee members about 4 weeks ahead of the exam date. It is expected that no more than one month will elapse from the time when the questions are posed until the exam takes place. To ensure this, many students find it beneficial to schedule the exam before collecting the questions. It is generally expected that each of the questions should be structured so that they take no more than 1 week for the student to answer. It is also expected that the student has the opportunity to consult with the faculty member during this time. The student prepares written answers to each of the questions, typically about 10 pages each. The student should provide a draft copy of all answers to each of the

committee members at least one week in advance of the A exam. (This may be waived at the discretion of the committee members, but doing so is not recommended.)

At the A exam, the student presents the answers to the posed questions in the form of a PowerPoint or similar presentation. The student should be prepared to address all three questions, typically with 5 to 10 slides on each. The committee asks questions during and after the presentation. These questions need not be limited to the content of the A exam questions, but may also probe the student's general comprehension of material related to the chosen research area. The student should also prepare a plan of the thesis topic, which may be a written document, or a presentation. This should be a detailed presentation if one of the committee members has asked that this serve as their "question". Otherwise, the student should be prepared to present this to the committee as a thesis plan outline of a one page document or 2 slides maximum. This may be waived at the discretion of the committee but doing so is not recommended.

The outcome of the A exam is decided by the permanent special committee. While the outcome is primarily determined by the student's performance in the exam, other factors (such as performance in research) may be taken into account. The possible outcomes are:

- A. Pass at the Ph.D. level. The student is formally admitted to Ph.D. candidacy status. The special committee may recommend the award of a Master's degree without thesis as an in- progress degree.
- B. Pass at the Master's degree level. The student may not continue to Ph.D. The special committee may recommend the award of a Master's degree without thesis as a terminal degree; or it may recommend that the student start work on a Master's thesis which should be completed in a timely manner (normally before the end of the third academic year of graduate work).
- C. In rare circumstances, the special committee may ask the student to retake the exam. The committee will determine the parameters of the retake in consultation with the DGS, and communicate them clearly to the student.

B Exam

The final Ph.D. Examination (B exam) is oral and is conducted by the student's special committee after the thesis has been accepted and all other prescribed work has been completed. The student gives a public talk lasting about 30-45 minutes, followed by a closed door session with the special committee. The exam is limited to the thesis and related subject matter.

The student must file a Schedule of B Exam form with the field no less than one week before the exam is to take place, but filing the form a month or more before the exam is strongly recommended. The Field of Physics strongly recommends that the thesis be circulated to the

student's special committee, in a form already suitable for submission, at least two weeks in advance of the B exam. The Graduate School mandates circulation at least one week in advance. The Physics DGS will sign the scheduling form and submit it to the Graduate School upon circulation of the thesis to the committee. The student should include the Graduate Field Assistant in the distribution list. This must occur at least one week in advance of the exam.

The student should prepare a poster no less than one week before the exam to advertise the public talk. The poster will be displayed in Clark Hall, Physical Sciences Building, and other locations if relevant. This satisfies the Graduate School requirement that the exam be posted a minimum of 7 days in advance. The poster must clearly state that it is a B Exam or PhD defense and include the student's name, the advisor's name, the title of the talk, the date, time, location and abstract. An image is preferred, but not required. The poster should be sent as a PDF or JPEG to the Graduate Field Assistant.

Master's Final Exam

Graduate students who decide not to pursue the doctoral degree may earn a Master's degree without thesis by completing four registration units (semesters). Candidates for the degree must have passed the Q exam, demonstrated mastery of the four core subjects (see Section II), and pass a final exam for the degree. Research is not required. The final exam may either be a special Master's final exam or an A exam passed at the Master's level or better. Students who take the special exam or pass the A exam only at the Master's level do not continue in the PhD program.

The Master's final exam is generally an oral exam administered by the special committee. The exam typically consists of a presentation by the student on a topic agreed to in advance by the committee. Adjustments to this format may be made with the consent of all committee members. In any case, the student and committee members should discuss the parameters of the exam ahead of time, so that there is a clear understanding of requirements and expectations. Before scheduling the examination, the student should request a change of status to Master's candidacy. This request can be made conveniently by the formal reorganization of his or her special committee.

Foreign Language Examinations

No foreign language is required for either a Master's or a Ph.D. degree with a major in the Field of Physics.

IV. Special Committees; Major and Minor Subjects

Each entering graduate student is assigned a temporary special committee consisting of three members of the field. This committee guides the student in choosing courses and exploring potential research areas. Its members may, or may not, represent the student's ultimate research

interests. The chair is chosen from a group of four “wise people” for each year who help facilitate communication from the field and Graduate School.

After the Q exam and when students’ plans for thesis research become reasonably firm, they should form a permanent special committee. The permanent committee must be formed by the beginning of the fifth semester in the program. Delays in permanent committee formation past this deadline may only occur in exceptional circumstances and are subject to the approval, via general petition, of the Graduate School. The permanent special committee is chaired by the student’s research advisor, who will supervise the student’s Ph.D. thesis. As such, formation of the permanent special committee formalizes a mutual commitment between the student and the advisor. The formal step of forming the permanent committee must be taken even if its membership coincides completely with that of the temporary committee assigned by the Field.

The permanent special committee formation is initiated by the student, who asks faculty members to join the committee. Students are encouraged to consult with their research advisors regarding committee membership most appropriate for their chosen research topics. Once an informal agreement of the prospective committee members is obtained, the student initiates the formal committee change via Student Center. The new committee composition must then be formally approved by the DGS, GFA and the entire committee. The rules governing committee composition are summarized below. Proposed committees that do not satisfy these rules will not be approved, unless an exception is authorized by the DGS in advance.

The chair of the permanent special committee must be the student’s primary research advisor. The chair must be a member of the Field of Physics. Please consult the Physics web site (<https://physics.cornell.edu>) or the Graduate Field Assistant for current field membership. A Cornell faculty member not currently associated with the Field of Physics may apply for a term-limited field membership in order to supervise a Physics graduate student. Students and/or prospective advisors interested in this option should contact the DGS for more information. The membership application should occur before the beginning of the student’s fourth semester in the program.

For a student pursuing a Ph.D. degree, the committee must have at least three members. Each committee member represents a concentration. The concentration represented by the chair of the committee is the student’s major subject. The concentration(s) represented by the other two members are the student’s minor subjects. Concentrations within the Field of Physics include Physics, Experimental Physics, and Theoretical Physics.

The special committee composition by concentration should be chosen from the following options:

Major in Experimental Physics

Chair – Experimental Physics

Minor Member - Theoretical Physics

Minor Member – Experimental Physics

Major in Theoretical Physics

Chair - Theoretical Physics

Minor Member – Experimental Physics

Minor Member – Theoretical Physics

If, and only if, the thesis advisor’s only concentration within the Field of Physics is “Physics”, the special committee composition must be the following:

Major in Physics

Chair – Physics

Minor Member – Experimental Physics

Minor Member– Theoretical Physics

Students whose major subject is either Experimental Physics or Theoretical Physics may choose to have one of their minors in another field. In this case, the special committee composition by concentration should be chosen from the following options:

Experimental Physics Major, Outside Minor

Chair – Experimental Physics

Minor Member - Theoretical Physics

Minor Member – Outside Minor

Theoretical Physics Major, Outside Minor

Chair - Theoretical Physics

Minor Member – Experimental Physics

Minor Member – Outside Minor

Students wishing to obtain a minor in a field other than Physics should consult with the DGS of that field regarding specific additional requirements (e.g. mandatory coursework) for that minor. It is the student’s responsibility to plan ahead and ensure that any such requirements are satisfied without compromising the time and effort spent on thesis research.

Students may choose to have additional members, beyond the required three, on their committees. The Graduate School requires that such faculty must be members of Cornell graduate faculty; the Field of Physics does not impose any additional restrictions. In addition, students may request that an individual who is not a member of Cornell graduate faculty be appointed as an *ad hoc* member of the special committee. This may be appropriate, for example, if the student’s thesis research involves a close collaboration with a non-faculty research staff member at Cornell, or a faculty at another institution. Requests for *ad hoc* appointments must be approved by the DGS and Graduate School.

Changes to the membership of the permanent special committee may be initiated by the student via Student Center at any time prior to the A exam (see Section III). Changes to the special committee after the A exam require a petition to the Graduate School, and for a significant change in research subfield may necessitate a new A exam.

V. Academic Standing; Student Progress Reviews

Milestones mandated by the Graduate School include formation of permanent special committee, completion of A exam, and the Time to Degree deadline. The student is considered to be in good academic standing by the Graduate School if all applicable milestones have been achieved, or petitions to extend the corresponding deadlines have been approved. In addition, for students in the 2nd year in the program and each year thereafter, the Graduate School requires that the annual Student Progress Review (see below) be completed. The Graduate School may impose holds on registration of students who lose academic standing by missing these deadlines, which may lead to loss of student status (including visa status for international students) and loss of eligibility for financial support such as TA and GRA appointments or disbursement of fellowships.

The Field of Physics has a few additional milestones. The Q exam must be taken in the 2nd semester in the program at the latest, and passed by the end of the 4th semester at the latest. Mastery of the Core material, including the PHYS 6510 requirement, must be completed before the A exam.

To be considered in good academic standing by the field, students who have not yet formed their permanent special committees should also maintain a full-time academic schedule. For students not involved in research, this means taking a full-time course load. The number of regular (3 or 4-credit) courses per semester considered to be full-time is two, if supported as a Teaching Assistant, or three, if supported by a Fellowship. Classes may be taken on a letter grade or pass/ fail (S/U) basis; classes taken as audits do not count towards this requirement. The minimum required grade is C, for letter grade courses, or S, for S/U grade basis. The coursework should be relevant for a Physics Ph.D. During the transition from coursework to full-time research, the number of courses taken should decrease in concert with the increase in time devoted to directed reading or research. Roughly, students should expect to spend 15-20 hours per week on such activities for each one-course reduction in the course load. The DGS or special committee chair may contact the faculty supervising reading or research to confirm that the full-time academic schedule requirement is being met during the transition.

First- and second-year students failing to maintain a full-time schedule or minimum grade requirements should expect to be asked to discuss the situation with the DGS and their temporary

special committees, and find ways to improve. If the situation does not improve over time, the student may lose eligibility for financial support.

Once a permanent special committee is formed, the student's level of effort and rate of progress towards Ph.D. should meet the expectations of the committee chair/research advisor. Students and advisors are strongly encouraged to discuss such expectations on a regular basis. In case of disagreements, the DGS should be contacted and will facilitate the discussion. The advisor's approval of the Student Progress Review constitutes a formal indication that the expectations are being met.

Student Progress Reviews

The Graduate School requires that each student in their second year and beyond complete a Student Progress Review (SPR). Each student will receive a link, along with specific instructions and deadlines, from the DGS regarding the SPR each year. Typically, students will complete the SPR early in the fall semester. Upon receipt of the instructions from the DGS, each student should schedule a meeting with their advisor (special committee chair) to review the SPR. The student should then follow the link to complete their SPR form and submit it for review by the advisor at least a week in advance of the meeting. The SPR is designed to facilitate discussions between student and advisor on research progress, career planning, and mentoring. After amending the SPR form based on the advisor meeting, the student will electronically submit the form. The advisor will then approve / comment on the form electronically, and submit it to the DGS and Graduate School.

VI. Financial Support

Financial support for students in the Field of Physics is provided through a combination of Fellowships, Teaching Assistantships (TA), and Graduate Research Assistantships (GRA). All of these provide a stipend sufficient to cover housing and living expenses in Ithaca, a tuition waiver, and medical insurance. The field provides each student with financial support for the first six years (12 semesters) of enrollment in the program during the regular semesters (fall and spring). A large majority of students also receive financial support during summer semesters. Financial support for students beyond the 12th semester may be possible, subject to availability. Financial support may be withdrawn if the student loses good academic standing (see section V), or does not meet performance expectations while appointed as a TA or GRA.

Fellowships

The term "Fellowship" refers to financial support that does not require the student to teach or to conduct research in a specific group. Fellowships may be internal, i.e. funded by Cornell, and

external, i.e. funded by outside sources such as US or foreign government agencies or private foundations.

Internal fellowships require nomination by the Field. The DGS will keep track of available internal fellowships and nominate prospective or current students as appropriate.

Students are strongly encouraged to apply for external fellowships. The field will endeavor to support such applications in every way possible; in particular, faculty are highly encouraged to help students prepare research plans/proposals required by many fellowships. Students are also encouraged to make use of the resources provided by the Graduate School to find information about available fellowships and to help with applications. Students who are awarded an external fellowship should notify the GFA immediately, even if they are not planning to use the fellowship right away. It is the fellowship recipient's responsibility to understand and maintain eligibility conditions for the duration of the fellowship. Partial fellowships may be eligible for Graduate School supplement; students should contact the GFA with questions concerning eligibility rules.

Teaching Assistantships

A Teaching Assistantship is an appointment in support of teaching a particular course, supervised by the instructor of the course (faculty or senior staff member). While the Field does not have a teaching requirement for a Ph.D., each graduate student is strongly encouraged to be a Teaching Assistant (TA) for at least one semester, even if other sources of financial support are available. Teaching experience helps students to improve their own understanding of physics, build confidence and presentation skills, and make a meaningful contribution to Cornell's educational mission.

Teaching assignments are made by the Department Manager in consultation with the DGS, the Department Chair, other appropriate faculty as needed, and with each grad in an ongoing way. An attempt is made to place TAs in courses that they would prefer to teach while considering other important factors such as experience, past performance, special training, course needs, etc. A vast majority of appointments are in Physics classes, although occasionally students may be offered a position in a class in a closely related department (e.g. Math). All TAs are provided with training prior to beginning their first appointment, and with ongoing support to help ensure success in the classroom. The responsibility for teaching physics, even at the most elementary level, is taken very seriously by the department, and all TAs are expected to maintain the high standard of teaching that is the norm at Cornell.

Typical responsibilities of a TA include teaching discussion sections and/or labs, grading homework assignments and exams, attendance at lectures and staff meetings. Specific responsibilities and expectations vary by course and need to be clearly specified by the supervisor (course instructor) at the start of the appointment. The Graduate School mandates that

the average hours for a TA over the duration of the appointment be no more than 15 hours a week, and that the hours in any individual week does not exceed 20. If a student is not able to meet the expectations within these limits, the issue should be discussed with the instructor, and steps should be taken to remedy the situation. (This may include advice on improving the TA's efficiency, as well as modification of duties.) In case of disagreements, the Department Manager and the DGS should be contacted and will facilitate the discussion.

International students whose native language is not English are required to demonstrate English proficiency to be eligible to hold a TA appointment. This is a university-wide requirement which cannot be waived or modified by the field. The assessment is conducted by the International Teaching Assistant Program (ITAP), which also offers classes to help students improve their English proficiency if necessary, and eventually meet the standard required to teach. If a student is not cleared to teach by ITAP, the field will do its best to identify other sources of financial support, but cannot guarantee support.

Students admitted with a TA offer are required to teach for the first two years (four semesters) in the program, unless a release is obtained. If a student is offered a GRA during this time, the field will provide a release whenever it is possible to do so without compromising TA staffing needs of the department. Release requests will be handled on a first come, first served basis.

Graduate Research Assistantships

A Graduate Research Assistantship is an appointment with a primary responsibility of conducting research related to the student's thesis. Typically, a Graduate Research Assistant (GRA) is supervised by the student's research advisor, although in some cases the supervisor may be different (e.g. if the student's project involves a close collaboration between multiple faculty). The responsibilities of a GRA position may vary widely depending on specific research area and project, but must focus on tasks advancing the student's thesis research. The supervisor should make the expectations clear at the start of each semester's appointment, including expected hours and other specifics as appropriate. In case of disagreements, the DGS should be contacted and will facilitate the discussion.

VII. In Absentia Status and Leaves of Absence

In Absentia Status

In absentia status provides an opportunity for graduate students to engage in approved study or research in a location at least 100 miles away from the university's Ithaca campus during the academic year while continuing to work under the guidance of the special committee. Semesters spent in absentia count as regular semesters towards any milestone deadlines. Students can

petition for in absentia status for up to two semesters at a time and can receive a fellowship or assistantship during this time. A petition needs to be filed with the required supporting documentation (https://gradschool.cornell.edu/wp-content/uploads/2018/09/In-Absentia-Form-revised-9_13_18.pdf). Students should obtain the approval of their entire special committee before bringing the entire packet to the GFA for DGS approval. The GFA can answer students' questions about this form or the process.

Leave of absence

Students may request a leave of absence for personal or medical reasons. A Leave of Absence is available for up to 12 months and is renewable. Time spent on leave does not count towards any milestone deadlines. A Health Leave is initiated by Cornell Health in consultation with the student. A personal leave is initiated by the student submitting a Leave of Absence form (<https://gradschool.cornell.edu/wp-content/uploads/2019/04/Leave-of-Absence-Form-041519.pdf>). Students should obtain the approval of their Special Committee Chair before bringing the form to the GFA for DGS approval. The GFA can answer students' questions about this form or the process.

VIII. Administration

This section contains information about the administrative structure at Cornell relevant for Physics graduate students, and defines some of the terms frequently used in the rest of this document.

The Graduate School

While undergraduate students at Cornell may be enrolled in one of the several Colleges, all graduate students, regardless of the field of study, are enrolled in the Graduate School. The Graduate School issues policies and requirements applicable to graduate students in all fields. It handles administrative aspects such as registration, record-keeping, leaves of absence, and degree conferral. In addition, the Graduate School provides a variety of resources in support of graduate students' professional development and overall well-being. More information is available at <https://gradschool.cornell.edu>

The Field of Physics

The Field is the next lower level of administration. There are 96 fields at Cornell; Physics is one of the largest. The Field sets educational policies specific to graduate students in Physics, which are summarized in this Guide.

The faculty of the Field of Physics includes all faculty (including Adjunct faculty) whose primary affiliation is with the Physics department; see <https://physics.cornell.edu/faculty> for an up-to-date list of Physics department faculty. In addition, a number of faculty whose primary affiliation is with another Cornell department are also members of the Field of Physics: see <https://physics.cornell.edu/field-faculty> for a current list. Faculty interested in joining the Field of Physics (which is required to serve as thesis advisor to a Physics graduate student) should contact the DGS.

The Director of Graduate Studies (DGS) assists students with policy questions, advice about interacting with faculty, difficulties in the program, help to resolve research group or committee issues, and graduate student stressors.

The Graduate Field Assistant (GFA) assists students with graduate program milestone requirements, scheduling exams, Graduate School forms, questions about committee changes, applying for a leave of absence or in absentia, fellowships awards, obtaining the DGS signature and making an appointment with the DGS.

The Department of Physics

The Department of Physics, which is a unit of the College of Arts & Sciences but not the Graduate School, determines what physics courses shall be offered and administers them. This includes both graduate and undergraduate courses. Teaching Assistantships are funded and supervised by the department. The Department Manager makes TA appointments (in consultation with the Department Chair, DGS and other faculty), and handles administrative matters related to these appointments.

Research in physics is administered (and budgeted) almost exclusively by other university units, e.g., by laboratories (LASSP, LEPP and CLASSE) and centers (CBB, CCMR, etc.), and research in allied areas by other departments. The stipends of research assistants come directly through the appropriate administrative unit, which also provides administrative support for all matters related to the GRA.

IX. The Physics Minor

Cornell graduate students admitted to fields other than Physics have an option of pursuing Physics as a minor Ph.D. subject. (The other two concentrations associated with the field of Physics, Theoretical Physics and Experimental Physics, cannot be pursued as minors for non- Physics students.) The requirements for the Physics minor are:

- A. A minor member of the student's special committee should be a member of the Field of Physics, and the concentration "Physics" should be selected for that member.
- B. Four Physics courses (each 3 or more credit hours). At least three of these four should be taken as a graduate student at Cornell. At least two courses must be at the advanced- undergraduate (numbered 3000 or above) or graduate (numbered 6000 or above) level. Independent Study courses such as PHYS 4490 or PHYS 7690 cannot be used to fulfill this requirement. Classes may be taken on a letter grade or pass/fail (S/U) basis; classes taken as audits do not count towards this requirement. The minimum required grade is C, for letter grade courses, or S, for S/U grade basis.

The committee member representing the Physics minor should confirm, prior to the B exam, that the course requirement for the minor has been satisfied. This committee member's signature on the B exam form certifies this.

Students outside the field can also pursue Physics as a minor subject for their Master's degrees. The requirements are the same as above, but the number of required Physics courses is reduced to three, at least two of which should be taken as a graduate student at Cornell. The committee member representing the Physics minor is responsible for certifying that the course requirement has been met prior to Master's Final exam (or A exam, as applicable).

Appendix: Course Recommendations Beyond the Core by Sub-Field

The courses listed in this Appendix have been recommended by members of the faculty in various research areas. Junior students interested in doing research with a particular faculty are encouraged to consult with the prospective advisor about course selection. Advanced students should consult with their advisors regularly to coordinate course selection.

Accelerator Physics:

Strongly Recommended:

PHYS 7656 Introduction to Accelerator Physics and Technology

PHYS 6574 Applications of Quantum Mechanics II

PHYS 7688 Advanced Topics in Accelerator Technology

Consider:

PHYS 7645 High-Energy Particle Physics I

PHYS 7646 High-Energy Particle Physics II

PHYS 7653 Statistical Physics II

PHYS 7680 Computational Physics

ECE 5810 Introduction to Plasma Physics (=A&EP 6060)

MAE 5790 Nonlinear Dynamics and Chaos (=MATH 4210)

PHYS 3360 Electronic Circuits

A&EP 7110 Principles of Diffraction

A&EP 4400 Quantum and Nonlinear Optics

Astrophysics Theory:

Strongly Recommended:

PHYS 6574 Applications of Quantum Mechanics II

ASTRO 6511 Physics of Black Holes, White Dwarfs and Neutron Stars (=PHYS 6525)

ASTRO 6560 Theory of Stellar Structure and Evolution

Consider:

PHYS 6553 + 6554 General Relativity (=ASTRO 6509 + 6510)

ASTRO 6516 Galactic Structure and Stellar Dynamics

ASTRO 6530 Astrophysical Processes

ASTRO 6599 Cosmology (= PHYS 6599)

ASTRO 7690 Computational Physics (=PHYS 7680)

PHYS 7635 + 7636 Solid State Physics I + II

PHYS 7645 Particle Physics

PHYS 7651 + 7652 Relativistic Quantum Field Theory I + II

ASTRO 4410 Experimental Astronomy

ASTRO 6525 Techniques of Optical/Infrared and Sub-millimeter Astronomy

ASTRO 6570 Physics of the Planets

ASTRO 6579 Celestial Mechanics

ASTRO 6590 Galaxies and the Universe
A&EP 6060 Introduction to Plasma Physics (=ECE 5810)

Condensed Matter Experiment:

Biophysics:

Strongly Recommended:

BIOMG 3300/3310/3320 Principles of Biochemistry

Consider:

PHYS 7635 Solid-State Physics I

PHYS 7653 Statistical Physics II

PHYS 3330 Modern Experimental Optics

PHYS 3360 Electronic Circuits

A&EP 4700 Biophysical Methods

BIOMG 4320 Survey of Cell Biology

BIOMG 6310 Protein Structure and Function

BIOMG 6330 Biosynthesis of Macromolecules

BIOMG 6360 Functional Organization of Eukaryotic Cells

CHEM 3570 + 3580 Organic Chemistry for the Life Sciences

CHEM 3590 + 3600 Honors Organic Chemistry I and II

CHEM 3890 + 3900 Honors Physical Chemistry I and II

Soft Condensed Matter Physics:

Strongly Recommended:

PHYS 7635 Solid-State Physics I

PHYS 7653 Statistical Physics II

Consider: (see also other courses listed under Biophysics)

PHYS 3360 Electronic Circuits

PHYS 3330 Modern Experimental Optics

PHYS 7654 Basic Training: Tools for Condensed Matter Theory

PHYS 7682 Computational Methods for Nonlinear Systems

CHEM 3570 + 3580 Organic Chemistry for the Life Sciences

CHEM 7960 Statistical Mechanics

CHEME 7310 Advanced Fluid Mechanics and Heat Transfer

M&AE 5790 Nonlinear Dynamics and Chaos

M&AE 6010 Foundations of Fluid Dynamics

M&AE 6110/6120 Solid Mechanics I/Solid Mechanics II

Solid State or Low Temperature Physics:

Strongly Recommended:

PHYS 6574 Applications of Quantum Mechanics II

PHYS 7635 Solid-State Physics I

Consider:

PHYS 7636 Solid-State Physics II
PHYS 7653 Statistical Physics II
PHYS 7654 Basic Training: Tools for Condensed Matter Theory
PHYS 3360 Electronic Circuits
PHYS 3330 Modern Experimental Optics
A&EP 4400 Quantum and Nonlinear Optics
A&EP 6610 Nanocharacterization
A&EP 6620 Micro/Nano-fabrication and Processing
A&EP 7110 Principles of Diffraction
MS&E 5850 Electronic, Magnetic, and Dielectric Properties
CHEM 6050/6060/6070 Advanced Inorganic Chemistry/Solid state Chemistry
CHEM 6290 Electrochemistry

X Ray Physics:

Strongly Recommended:

PHYS 7635 Solid-State Physics I
A&EP 7110 Principles of Diffraction

Consider: (see also other courses listed under the other sub-fields of Condensed Matter Experiment)

PHYS 6574 Applications of Quantum Mechanics II
PHYS 7636 Solid-State Physics II
PHYS 7653 Statistical Physics II
PHYS 7654 Basic Training: Tools for Condensed Matter Theory
PHYS 7656 Introduction to Accelerator Physics and Technology

Condensed Matter Theory:

Strongly Recommended:

PHYS 7635 Solid-State Physics I
PHYS 7636 Solid-State Physics II (optional for biophysics theory)
PHYS 7653 Statistical Physics II
PHYS 7654 Basic Training: Tools for Condensed Matter Theory
PHYS 7680 Computational Physics

Consider:

PHYS 6574 Applications of Quantum Mechanics II
PHYS 7651 Relativistic Quantum Field Theory I
PHYS 7652 Relativistic Quantum Field Theory II
PHYS 7681-7689 Relevant special topics courses
PHYS 7681: Quantum Information Processing
M&AE 5790 Nonlinear Dynamics and Chaos

CHEME 7310 Advanced Fluid Mechanics and Heat Transfer
M&AE 6010 Foundations of Fluid Dynamics

Elementary Particle Experiment:

Strongly Recommended:

PHYS 7645 High–Energy Particle Physics I
PHYS 7646 High–Energy Particle Physics II
PHYS 7651 Relativistic Quantum Field Theory I

Consider:

PHYS 6574 Applications of Quantum Mechanics II
PHYS 7656 Introduction to Accelerator Physics and Technology
PHYS 3360 Electronic Circuits
PHYS 7652 Relativistic Quantum Field Theory II
ASTRO 6599 Cosmology (=PHYS 6599)

Elementary Particle Theory:

Strongly Recommended: (QFT I and II are required prior to starting research, unless mastery of the material is demonstrated by other means)

PHYS 6574 Applications of Quantum Mechanics II
PHYS 7651 Relativistic Quantum Field Theory I
PHYS 7652 Relativistic Quantum Field Theory II
PHYS 7661 Advanced Topics in High-Energy Particle Theory (At least one semester. Taking PHYS 7661 more than once is encouraged, as topics vary from year to year.)

Consider:

PHYS 6553 + 6554 General Relativity
ASTRO 6599 Cosmology (=PHYS 6599)
PHYS 7645 + 7646 High–Energy Particle Physics I + II
PHYS 7681: Quantum Information Processing

Students conducting research in other sub-fields should consult regularly with their advisors and special committee members to formulate an appropriate sequence of courses.