

**Manual
For
Physics and
Astronomy
Graduate Students**

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1. New Graduate Student Orientation

Most new graduate students begin their studies in the fall semester and must arrive at Purdue in time for an orientation meeting that begins at 8:00am EDT on the Monday before fall-semester classes begin. Its purpose is to introduce you to key faculty, staff and student representatives who will help you get ready to begin your work and study in the Department of Physics and Astronomy.

Some of that meeting will follow up on communications sent to you after being admitted to the graduate program. For example, you will be reminded of the Qualifying Examination you are required to take on the Monday and Tuesday afternoons of orientation week and will schedule a meeting with your initial academic advisor later during orientation week. You will also learn about meetings that Purdue University requires of all new graduate students to attend and about practical matters like payroll signup. Finally, if you will be paid for working as a Teaching Assistant, you will learn about required meetings for new instructional staff that will help you prepare for that work.

If you are the rare new graduate student who begins your studies in the spring semester, the chair of the Graduate Student Oversight Committee will facilitate your orientation.

As you begin your graduate studies you should be aware that your progress will be measured by your grades, the quality of research you do, and your performance as teaching or research assistants. The Graduate Student Oversight Committee evaluates each student's progress each semester to determine whether or not they should be permitted to continue graduate work.

2. The Qualifying Exam

New graduate students must take the Qualifying Examination whose two 3-hour parts are given the afternoons of Monday and Tuesday during orientation week. The examination tests knowledge of classical mechanics at the level of texts like *Classical Dynamics of Particles and Systems* by Marion and Thornton; of electricity and magnetism at the level of texts like *Introduction to Electrodynamics* by Griffiths; of quantum physics at the level of texts like *Introduction to Quantum Mechanics* by Griffiths; and of thermal physics at the level of texts like *Thermal Physics* by Kittel and Kroemer. Finally, a general knowledge of modern physics at the level of the texts like those by Weidner and Sells, Krane, Sandin, Serway and Tipler is required.

The faculty committee that prepares and grades the Qualifying Exam gives roughly equal coverage to each of the four subject areas mentioned above: classical mechanics, electricity and magnetism, quantum mechanics, and thermal physics/modern physics. The maximum possible score is 160 points. There is no preset passing score. The examination committee sets the minimum passing score after the exam is graded based on their judgement of the minimum initial knowledge required for students to begin successful work toward a Ph.D. degree.

Students who do not pass the Qualifying Exam on their first attempt have at most two additional opportunities to do so. The first is before the beginning of the spring semester of their first year at Purdue. The second, if necessary, is before the beginning of the fall semester of their second year. Failing the Qualifying Exam on that final attempt is sufficient reason to deny a student candidacy for the Ph.D. degree. Note, however, that students in that position may still be able to earn the M.S. degree (see section 6 below).

3. Your Departmental Plan of Study

Later during orientation week you will meet with your initial academic advisor to review your performance on the Qualifying Examination, discuss the appropriateness of requesting core course equivalences and complete a Departmental Plan of Study for review by the Graduate Student Oversight Committee.

Your Departmental Plan of Study must lay out a realistic course of study taking no more than two years for you to achieve either a terminal M.S. degree or certification as meeting departmental standards in physics. To be certified you must pass the Qualifying Examination and each of the courses in the Core Program: Statistical Mechanics (PHYS 61700), Advanced Theory of Electricity and Magnetism I (PHYS 63000) and Quantum Mechanics I and II (PHYS 66000 and 66100) with a grade of B- or better. Certification is required before any student can finalize the selection of a Ph.D. major professor and register for Ph.D. research (PHYS 69900).

Students who pass the Qualifying Exam on their first attempt and who have passed courses comparable to one or more of the Core Program courses in other physics departments with scores equivalent to grade point scores of 3.0/4.0 may file requests for core course equivalences. Each request must provide evidence of successful completion of the comparable course and will be evaluated by a designated faculty member. That evaluation will be reviewed by the Graduate Student Oversight Committee which will then decide whether or not

equivalence should be granted. Equivalence requests for the courses Advanced Theory of Electricity and Magnetism I (PHYS 63000) and Quantum Mechanics I (PHYS 66000) must be submitted before the end of the first week of classes of your first semester at Purdue.

Equivalence requests for the courses Thermal Physics (PHYS 61700) and Quantum Mechanics II (PHYS 66100) must be submitted before the end of the first week of classes of your second semester at Purdue.

Students who do not pass the Qualifying Exam on their first attempt should discuss with their academic advisor whether or not to enroll in 400- or 500-level Physics courses to prepare for their next attempt to pass it. You should be aware the no graduate credit is awarded for 400-level courses but, also, that failure to pass the Qualifying Exam on the second attempt makes successful pursuit of a Ph.D. degree difficult.

As you and your advisor prepare your Departmental Plan of Study remember that you are required to register for at least two 500- or 600-level physics courses each semester until you earn a terminal M.S. degree or are certified as meeting departmental standards in physics. To pursue a Ph.D. degree you must be certified by the end of your second year as a graduate student. So, you should plan to complete the four Core Program courses as soon as possible if a Ph.D. degree is your goal.

If you are a Graduate Teaching Assistant (GTA), you must take the Pedagogical Methods for Physics Graduate Students course (PHYS 60500) during your first semester. It will help prepare you for your work as a GTA. The course is strongly recommended for all graduate students.

During your first year as a graduate student you must also register for the Graduate Research Seminar course (PHYS 69600). Its purpose is to acquaint you with fields for specialized study and to introduce you to possible major professors and their research programs. To that end, it is also expected that you will regularly attend Departmental Colloquia and Seminars in their fields of interest. To learn more, we encourage you to contact professors directing research in fields you are interested in as you progress toward certification.

4. Selecting Your Major Professor

To receive the M.S. degree, you must find a Physics and Astronomy Department faculty member who is willing to act as your major professor. Your major professor will direct you in preparing and filing your M.S. Plan of Study with the Graduate School and direct any thesis research undertaken for the M.S. Thesis Option (see section 6 below). All of the preceding steps

must be completed *no later than the end of the semester before the semester in which the degree is to be awarded, for example, by December for a degree to be awarded in May.*

As a step toward research leading to the Ph.D. degree you must seek out a potential Ph.D. major professor once you have passed the Qualifying Exam and at least one of the Core Program courses at the required B- level or above. A potential major professor must have a Physics and Astronomy Department faculty appointment and agree to act as your academic advisor and supervise your work in a Reading and Research course (PHYS 59000).

It is expected that you will take no more than three PHYS 59000 courses before connecting with a faculty member who is willing to act as your Ph.D. major professor. Once you are certified and a faculty member has agreed to act as your Ph.D. major professor, your major professor will direct you in preparing your Ph.D. Plan of Study for the Graduate School and direct your Ph.D. research (PHYS 69900).

5. Your Advisory Committee

As noted in the preceding section, you and your major professor will work together to prepare a M.S. or Ph.D. Plan of Study to be filed with the Graduate School. Note that once a Plan of Study is filed with and approved by the Graduate School, any changes to the Plan of Study must be requested from and approved by the Graduate School. The form requesting changes must explain the reasons for making them and be signed by the student, their major professor and the Head of the Department. In the case of changes to a M.S. thesis-option or Ph.D. Plan of Study, the form requesting changes must also be signed by members of the student's Advisory Committee.

The preparation of a M.S. thesis-option or Ph.D. Plan of Study entails the selection of an Advisory Committee. Your major professor is the Chairman.

A M.S. thesis-option Advisory Committee consists of at least two persons in addition to the Chairman. The Chairman and at least one of the other two members must hold Physics and Astronomy Department faculty appointments. The third member must be a faculty member in the Physics and Astronomy Department or in a department in which the student takes a minor program of six or more credit hours.

The functions of a M.S. thesis-option Advisory Committee are to monitor the student's progress, to approve the M.S. thesis-option Plan of Study and, if possible, to serve as the examining committee for the M.S. thesis-option Final Examination.

A Ph.D. Advisory Committee consists of at least three persons in addition to the Chairman. At least two of those three additional members of the Committee must have a regular full-time, part-time or partial appointment in the Physics and Astronomy department rather than an adjunct or courtesy appointment. The required third additional member may either be a Physics and Astronomy Department faculty member or a professor from another department provided that they are working in a research field closely related to the field of the student's thesis research. The Committee must include a theoretical physicist, an experimental physicist and a member working outside the student's field of research.

The functions of a Ph.D. Advisory Committee are to monitor the student's progress, to approve the Ph.D. Plan of Study and, if possible, to serve as the examining committee for the Ph.D. Preliminary and Ph.D. Final Examinations.

6. M.S. Degree Requirements

Most students receiving the M.S. degree do so via the non-thesis option. However, a thesis option is available for a student desiring research experience as long as a physics and astronomy faculty member will agree to supervise the work as their major professor.

Graduate students admitted to Purdue without a master's degree are encouraged to obtain the M.S. degree during their course of study here. For some students this will be a terminal degree, but most plan to continue work toward a Ph.D. degree. Continuing students can usually satisfy the non-thesis M.S. degree requirements without delaying their progress toward a Ph.D. degree. To do so the student must simply find a M.S. non-thesis option major professor, prepare an M.S. degree Plan of Study, and pass a course or two required by the M.S. degree program but not the Ph.D. degree program, e.g., a mathematics course or laboratory course. In the process, the continuing student profits by earning a graduate degree in physics just in case unforeseen circumstances cause an interruption or termination of their Ph.D. studies.

M.S. Degree Non-Thesis Option Degree Requirements:

(1) A score on the Qualifying Examination deemed appropriate by the Qualifying Examination Committee and that is no more than 25 points below the lowest passing score.

(2) The satisfactory completion of 24 credit hours of 500- and 600-level physics courses, including one laboratory course, and in addition, 6 credit hours of 500- or 600-level mathematics courses (which may be replaced in whole or in part by PHYS 60000, 60100). To count toward this requirement the grades of 500-level physics course must be B- or better, the grades of 600-level physics courses must be C- or better and the grades of 500- and 600-level mathematics courses must be C- or better. The student must file a M.S. non-thesis option Plan of Study with the Graduate School listing the courses taken. The Plan of Study must be signed by the student's major professor, the Head of the Department and, when approved by the Graduate School, the Dean of the Graduate School. Once a Plan of Study has been filed and approved, it can only be amended by written application to the Dean of the Graduate School, see section 5.

(3) A grade index of 2.80/4.0 or higher. The Registrar's Office deletes a first grade from a student's graduation index if that specific course was originally taken while the student was enrolled as a graduate student and is subsequently repeated for credit and a grade. The graduation index for graduate students will include all grades earned in 500- and 600-level courses taken while enrolled as a graduate student. In addition, once approved by the Graduate School as a part of the M.S. non-thesis option Plan of study it is possible for the graduation index to include grades received in up to 6 hours of approved 300- and 400-level undergraduate courses taken while in the graduate program. To be clear, grades for such courses will be added into the graduation index only once they are listed on the approved plan of study.

M.S. Thesis Option Degree Requirements:

(1) A score on the Qualifying Examination deemed appropriate by the Qualifying Examination Committee that is no more than 25 points below the lowest passing score.

(2) The satisfactory completion of 21 credit hours of 500- and 600-level physics courses, including 6 credit hours of 500- or 600-level mathematics courses (which may be replaced in whole or in part by PHYS 60000, 60100). In addition, 9 credit hours of physics research supervised by the student's major professor (PHYS 69800) is required. To count toward this requirement the grades of 500-level physics course must be B- or better, the grades of 600-level physics courses must be C- or better and the grades of 500- and 600-level mathematics courses must be C- or better. Students engaged in PHYS 698 research are to set research goals

with their major professor. The procedures of the College of Science require that the student meet annually with their Advisory Committee to assess their progress toward those research goals and, when appropriate, amend them. The student must file a M.S. thesis option Plan of Study with the Graduate School listing the courses taken. The Plan of Study must be signed by the student's major professor, members of their Advisory Committee, the Head of the Department and, when approved by the Graduate School, the Dean of the Graduate School. Once a Plan of Study has been filed and approved, it can only be amended by written application to the Dean of the Graduate School, see section 5.

(3) A grade index of 2.80/4.0 or higher. The Registrar's Office deletes a first grade from a student's graduation index if that specific course was originally taken while the student was enrolled as a graduate student and is subsequently repeated for credit and a grade. The graduation index for graduate students will include all grades earned in 500- and 600-level courses taken while enrolled as a graduate student.

In addition, once approved by the Graduate School as a part of the M.S. thesis option Plan of study it is possible for the graduation index to include grades received in up to 6 hours of approved 300- and 400-level undergraduate courses taken while in the graduate program. Grades for such courses will be added into the graduation index only once they are listed on the approved plan of study.

(4) The final oral examination covers thesis research and the content of courses on the student's M.S. thesis-option Plan of Study. The Examination Committee consists of at least three members and will usually consist of members to the student's Advisory Committee.

7. Ph.D. Degree Requirements

The Ph.D. Plan of Study should give the student a relatively broad acquaintance with the general field of physics and form a firm basis for their specialization and thesis research. No fixed number of credit hours is required, but Ph.D. candidates must complete the Core Program described in (2) below. Other specific requirements that must be satisfied by a Ph.D. candidate in the Department are described in the remainder of this section.

Ph.D. Degree Requirements:

(1) A passing score on the Qualifying Examination, see section 2.

(2) Completion (or equivalence, see Section 3) of each of the following Core Program courses with a grade of B- or better: PHYS 61700 (Statistical Mechanics), PHYS 63000 (Advanced Theory of Electricity and Magnetism I) and PHYS 66000 and 66100 (Quantum Mechanics I and II).

(3) Identify a major professor by the process discussed in section 4. In that process professors who agree to supervise you in Reading and Research courses (PHYS 59000) will be your academic advisor and help you select courses to meet requirement (6) below.

(4) Once certified, i.e., having satisfied requirements (1) and 2) above, notify the Graduate Office when you have identified a faculty member who agrees to be your major professor. It is expected that this will occur soon after becoming certified and, in any event, before the beginning of your third year as a student in the department. A formal request for an extension of that deadline must be submitted to the Graduate Education Oversight Committee by a student before the end of the summer session following their fourth semester at Purdue. The Committee will evaluate it and decide whether or not to grant it.

(5) Identify, with the help of your major professor, the rest of your Ph.D. Advisory Committee as discussed in section 5 above. Your Committee will help you select courses to meet requirement (6) below and guide your progress toward the timely submission of your Ph.D. Plan of Study to the Graduate School, your Ph.D. research (PHYS 69900) and the timely completion of your Ph.D. Preliminary and Ph.D. Final Examinations (see section 8 below).

Your Ph.D. Plan of Study may list only 500-level physics courses with grades of B- or better and 600-level physics courses with grades of C- or better. The Plan of Study must be signed by the student's major professor, members of their Advisory Committee, the Head of the Department and, when approved by the Graduate School, the Dean of the Graduate School. Once a Plan of Study has been filed and approved, it can only be amended by written application to the Dean of the Graduate School, see section 5 above.

Normally, your Advisory Committee will serve as your Ph.D. Preliminary Examination Committee and your Ph.D. Final Examination Committee. In the interest of transparency, you must submit requests to replace members of your Advisory, Preliminary Exam or Final Exam Committees to the Graduate Education Oversight Committee for approval. The request should clearly document the reasons you think the changes are necessary and justified.

(6) In addition to the Core Courses, each graduate student must take at least 3 Specialty Courses approved by the Physics and Astronomy Department. Almost all 500 and 600-level courses offered by the Physics and Astronomy Department are currently approved. The exceptions include remedial courses such as PHYS 51500, 52100 and 55000 and preparatory or skills courses such as 53600, 59000, 60000 and 60100. Your major professor must approve, through an e-mail to the Graduate Office, the use of any course taken outside the Physics and Astronomy Department as a Specialty Course. A graduate level course taken in a department at Purdue other than the Physics and Astronomy Department may be approved by the Committee. While graduate level physics courses taken at other universities may be transferred to Purdue, they may not be used as Specialty Courses.

In addition to Core and Specialty Courses, a student may take (a) any 500 level courses that may be needed in order to achieve a level of proficiency adequate for good performance in the core courses, (b) laboratory courses needed in preparation for the thesis research, (c) any courses recommended by the Advisory Committee to broaden preparation in physics, and (d) an advanced course or courses in the field of specialization.

(7) Ph.D. research (PHYS 69900) is work toward the research goals set and agreed to by you, your major professor and the other members of your Advisory Committee. You must keep your major professor and Advisory Committee members informed of progress in your agreed research program and meet with them, either as a group or individually, at least once a year for that purpose, as required by the procedures of the College of Science. Guidance they provide during these sessions reviewing your progress will ensure the timely completion of your thesis and your Ph.D. Preliminary and Ph.D. Final Examinations (see sections 8 and 9 below).

(8) The Graduate School must be notified of the time and place of your Ph.D. Preliminary Examination at least two weeks in advance. A student who fails the examination on the first attempt may be granted a second try by the Preliminary Examination Committee. Appeals of decisions made by that Committee may be made to the Graduate Education Oversight Committee.

The Graduate School must be notified of the time and place of your Ph.D. Final Examination at least two weeks in advanced and published so that interested faculty members and students may attend. The Examination covers the content of the thesis research and related subject matter. The Dean of the Graduate School reserves the right to appoint additional members of your Ph.D. Final Examination Committee.

(9) Preparation of your Ph.D. thesis is one way in which you will disseminate the results of your research. Its content is subject to the approval of your major professor; its format is subject to the regulations of the department and the Graduate School (see the “Policies and Procedures Manual of the Graduate School”). The Thesis/Dissertation Office, Room 179, Young Hall, can provide useful guidance when preparing your thesis document and links to LaTeX and Microsoft Word thesis templates.

Regulations of the Graduate School require that your thesis, once approved, be microfilmed for archival storage. You are responsible for making sure that corrections to your thesis are made and approved by your Final Examination Committee and the Graduate School and for the costs of microfilming and duplicating copies of your thesis required by the Graduate School. Format of your thesis will be reviewed by the staff in the Thesis/Dissertation Office, Room 179, Young Hall, during your final thesis deposit appointment.

There is at least one commercial copy shop that can help you with the preparation of your thesis document. Departmental secretaries are not to be asked to do this on departmental time but may agree to do so if paid to work on their own time.

Publication of at least one article on the results of your Ph.D. research in an appropriate, refereed scientific journal is a departmental requirement for the Ph.D. degree.

8. Policy on Time to Ph.D. Degree

The College of Science mandates that seven years from entry into the graduate program (i.e., 14 semesters plus the intervening summer sessions plus a final summer session to finish, if necessary) is the maximum time allowed to complete a Ph.D. degree in the College of Science.

Each semester after 6 or more semesters in the Ph.D. program a student who has not submitted a Ph.D. Plan of Study to the Graduate School or not completed their Preliminary Examination will, along with their major professor, receive a letter from the Graduate Education Oversight Committee requesting that they send the Committee a co-signed letter laying out a realistic plan to pass those milestones on the road to timely completion of the Ph.D. degree. When necessary, the Committee will request clarification or modification of the proposed plan. Copies of this correspondence will be placed in the student’s file. Cases of repeated failure to pass the Preliminary Examination milestone will be referred to the Head of the Department.

Each semester after 10 or more semesters in the Ph.D. program a student who has not completed their Ph.D. will, along with their major professor, receive a letter from the Graduate Education Oversight Committee requesting that they send the Committee a co-signed letter laying out a realistic plan for completing the Ph.D. degree by the College of Science deadline. When necessary, the Committee will request clarification or modification of the proposed plan. Copies of this correspondence will be placed in the student's file.

After 14 semesters in the Ph.D. program, plus a final summer session, the Graduate Education Oversight Committee mandates that a student who has not completed their Ph.D. will not be permitted to enroll. The student's major professor and advisory committee can appeal this ruling to the Committee which will consider such appeals case-by-case.

9. International Students: Oral English Proficiency Program

The University has instituted an Oral English Proficiency Program (OEPP) to ensure that language and cultural barriers do not diminish the effectiveness of instructors whose native language is not English and who have not had experience in American undergraduate colleges.

Non-native English speaking graduate teaching assistants (GTAs) are required to take the OEPP screening upon entrance and pass it at the level of contact teaching or, in case of failure, to register for the remedial oral English course in the first semester. Immediately after arrival on campus, international students should make arrangements with the Graduate Secretary to schedule the OEPP screening during the orientation period. As a result of this evaluation registration may be required in a special course, English 620, "Classroom Communication in ESL for Teaching Assistants". The English 620 instructors can grant the OEPP certification at the end of semester. Please, remember that a passing grade for English 620 is not equivalent to the OEPP certification.

Satisfaction of the OEPP requirement is an important part of your job performance. It can affect the level of financial support you receive, including opportunities to teach during summer sessions. Students from India, Bangladesh and Pakistan are also required to take this test. International students who would not get the OEPP certification within the first two years at Purdue are not eligible for a teaching assistantship. The two-year limit does not apply to research assistants. During this two-year period, international students without OEPP certification are eligible for GTA positions working as graders. Summer semesters are exceptions because there are almost no grading positions during summer semester.

International graduate students without OEPP certification should not expect any teaching position in summer (including their first two years at Purdue).

Any exceptions to this policy will require approval by the Department Head.

10. Graduate Student Ombudspersons and Appeals

The Department of Physics and Astronomy has two faculty members who serve as Ombudspersons. It is their responsibility to help graduate students with problems due to interactions with other graduate students, faculty or staff and with problems involving their teaching duties or academic work that cannot be resolved with the help of others, e.g., their academic advisor or a course instructor.

If the ombudspersons are unable to resolve a problem, please bring the matter to the attention of the Department Head. Another resource is a peer ombudspersons provided by the Graduate School. If necessary, please contact to the Graduate School about this option.

Note, a student who is in jeopardy of being terminated from the graduate program because they have not made satisfactory progress toward completion of the M.S. or Ph.D. program has the right to appeal to the Graduate Student Oversight Committee.