

College of Arts and Sciences
Department of Physics and Astronomy
University of South Carolina

Graduate Student Handbook



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UNIVERSITY OF
SOUTH CAROLINA

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This handbook is intended to compliment and reflect The Graduate School's regulations as outlined in the [Graduate Studies Bulletin](#). It outlines the Department of Physics and Astronomy's academic requirements for the Master of Science and Doctor of Philosophy programs. In certain circumstances, exceptions to these requirements may be made by the entire faculty. Graduate students are encouraged to become familiar with the policies outlined in both this handbook and the [Graduate Studies Bulletin](#).

EXPECTED UNDERGRADUATE BACKGROUND

Adequate preparation for graduate study ordinarily presupposes a bachelor's degree in physics or an allied field. Students who lack some of the usual undergraduate courses in physics may be required to take additional course work as a part of their program.

Prior to their admission to this department, entering graduate students are expected to have passed with a grade of C or better the following courses or their equivalent:

Quantum Physics (PHYS 501, 502)
Mechanics (PHYS 503)
Electromagnetic Theory (PHYS 504)
Kinetic Theory and Statistical Mechanics (PHYS 506)
Nuclear Physics (PHYS 511)
Solid State Physics (PHYS 512)

Mathematics through advanced calculus, including ordinary and partial differential equations and vector analysis, also should have been completed in the undergraduate program. Students with deficiencies in these courses must make them up during their initial two years of graduate studies as explained in the MS and PhD Program Requirements.

COURSE REGISTRATION AND ACADEMIC ADVISEMENT

The department has an advisement committee, which provides academic advisement for all MS students and PhD students. These students should consider the Advisement Committee to be their official advisor.

Students should register via my.sc.edu after being advised by the Advisement Committee or their advisor. Please note the following:

- A departmental advisement form must be filled out in consultation with the advisor and the Director of Graduate Studies.
- Changes in the approved course schedule made after advisement must have the consent of the Director of Graduate Studies.

- Research (PHYS 760 and PHYS 761) must be approved by the professor in charge of the section.
- Thesis Preparation (PHYS 799) and Dissertation Preparation (PHYS 899) must be approved by the professor in charge of the section and the Director of Graduate Studies.
- The Advisement Committee will recommend specific actions to the faculty if these advisement procedures are not followed. Failure to follow the Advisement Committee's recommendations may result in immediate termination of TA appointments.

GENERAL ISSUES

- All teaching assistants are expected to spend 20 hours per week on teaching duties, as per university policy.
- All TAs must be on campus no later than the official Faculty Reporting Day at the beginning of the fall semester, and at least 3 working days before classes begin for the spring semester.
- The TA appointment is given for one year and is subject to annual evaluation before renewal.
- All students must maintain an e-mail address and inform the Student Services Coordinator of their current address, phone number, and e-mail address. Any changes should be reported as soon as possible.
- Graduate students are strongly encouraged to utilize research resources within the department. In particular, they should participate in colloquia and seminars by attendance.
- Students are required to have a PhD committee formed within six months of passing the A to C examination. This committee will review the student's performance each semester to monitor his or her education and research performance to ensure efficient and timely progress of their PhD degree completion.
- At the end of each academic year, all students are required to complete a "Resume of Activity" form which addresses individual education/research performance (courses taken, labs taught, abstract submitted, presentations done, etc.). This form (together with the assessment mentioned above for students who have passed the A to C exam) will be used for evaluating the student's performance and renewal of TA appointment.
- If a student receives a grade of D+ or below in a course, he/she must retake the course.
- Students are encouraged to keep in touch with the department after they graduate. We urge them to inform us of their new address, phone number, e-mail address, and employment.

SEQUENCE OF EVENTS

Sequence of Events for MS Degree

- 1) Courses
- 2) Program of Study filed with The Graduate School by Student Services Coordinator
- 3) Thesis given to Director of Graduate Studies, thesis director, and second reader (student must also submit thesis to The Graduate School for format review)
- 4) Thesis defense and Comprehensive Exam at least 30 days before graduation

Sequence of Events for PhD Degree

- 1) Courses
- 2) Admission to Candidacy Exam after one/two years
- 3) Post-candidacy students on TAs meet with Department Chair, Director of Graduate Studies, and their advisor to justify TA
- 4) Residency requirement
- 5) PhD committee to be formed
- 6) Program of Study filed with The Graduate School by the Student Services Coordinator
- 7) Proposal submitted to Director of Graduate Studies and PhD committee members
- 8) Proposal defense and Comprehensive Exam at least one week later but no more than six months after Admission to Candidacy Exam
- 9) PhD dissertation to be defended at least one year but no more than five years after the Comprehensive Exam
- 10) Dissertation submitted to Director of Graduate Studies and PhD committee members (student must also submit dissertation to The Graduate School for format review)
- 11) Dissertation defense at least two weeks after dissertation is submitted to Director of Graduate Studies and PhD committee members (dissertation defense must take place at least 30 days before graduation)

MASTER OF SCIENCE REQUIREMENTS

Students working toward an MS degree are required to file a Program of Study as stated in the [Graduate Studies Bulletin](#). Some credit for courses completed at other institutions may be granted by the Director of Graduate Studies subject to restrictions specified in the [Graduate Studies Bulletin](#).

Summary of Requirements

Coursework

Thesis

Comprehensive Examination

Thesis Defense

Coursework

A minimum of thirty semester hours of coursework is required. At least 18 hours of the minimum course credit requirements must be obtained in graduate courses (700 level). Quantum Mechanics (PHYS 711) and one of the following:

Classical Mechanics (PHYS 701)
Classical Field Theory I (PHYS 703)
Classical Field Theory II (PHYS 704)
Statistical Thermodynamics (PHYS 706)
Quantum Mechanics (PHYS 712)

must be included in the program. Up to 6 hours of Thesis Preparation (PHYS 799) may be counted. The following courses are not applicable to the 18-hour minimum requirement:

Graduate Seminar (PHYS 730)
Selected Topics in Physics (PHYS 740)
Research (PHYS 760 and PHYS 761)

It is expected that the entering student has taken the seven 500-level courses or their equivalents mentioned earlier. If some of these 500-level courses or their equivalents have not been taken, they must be completed during the initial two years of graduate studies. Up to 12 hours of 500-level courses can be used to complete the 30-hour requirement.

Thesis

The thesis involves either (a) the solution of an acceptable research problem chosen by the student or suggested by his/her advisor, or (b) a lucid, informative discussion, in the nature of a review article and not obtainable elsewhere, on some currently important topic.

Comprehensive Examination

The student must pass a comprehensive oral examination, which covers material contained in the Bachelor of Science program, as well as graduate-level work which the student has completed at the time. The examination is ordinarily administered as part of the thesis defense.

Thesis Defense

The student must submit the thesis to the Director of Graduate Studies and faculty committee consisting of the thesis director and one reader at least two weeks before the date of the examination. The committee will administer the comprehensive examination/thesis defense. A satisfactory performance is required for a degree.

DOCTOR OF PHILOSOPHY REQUIREMENTS

The PhD degree is awarded to those students who have satisfied the faculty that their knowledge of, and insight into, physics and their demonstrated ability in planning and carrying out research publishable in standard refereed physics journals have prepared them for a scholarly career in physics with the potential for continued professional growth and achievement. The primary means of demonstrating this is a dissertation based on original research carried out by the student. MS degree students who have finished their MS degree at USC and want to continue with the USC PhD program should apply to the Admissions Committee.

Some credit for courses completed at other institutions may be granted by the Director of Graduate Studies subject to restrictions specified in the [Graduate Studies Bulletin](#).

Summary of Requirements

Coursework
Admission to Candidacy Examination
Residency Requirement
Teaching Experience
Research Proposal and Comprehensive Examination
Dissertation
Dissertation Defense

Coursework

A minimum of sixty semester hours of graduate-level coursework is required (or 30 past an MS degree). The minimum course requirements for the doctorate are satisfactory completion of:

PHYS 701	Classical Mechanics (3 credits)
PHYS 703	Classical Field Theory I (3 credits)
PHYS 704	Classical Field Theory II (3 credits)
PHYS 706	Statistical Thermodynamics (3 credits)
PHYS 711	Quantum Mechanics I (3 credits)
PHYS 712	Quantum Mechanics II (3 credits)
PHYS 713	Advanced Quantum Theory (3 credits)
PHYS 7xx	Advanced 700-level courses (9 credits)

Students will take a placement exam upon arrival. Students will meet with the Advisement Committee and be advised based on the results of their exam. Less prepared students are advised to take 500-level courses but are not required to do so. Additionally, they may be advised to take one or more but not all of the 500-level courses. For example, if they are strong in one area but weak in another, they may need to take the 500-level courses in the weak areas and take the 700-level courses in the strong areas. If the Advisement Committee finds the student deficient in his/her mathematical background, then the committee may advise the student to take Mathematical Physics I and II (PHYS 515 and 516). All students are expected to take one or more advanced graduate courses in fields outside of their specialty to broaden their background. Before deciding upon a research field, a student may take Research (PHYS 760 or 761) to become familiar with the research work being carried out by a particular research group.

The nine credits of advanced graduate courses may include both regular courses (no limit) and topics courses (no more than 3 credit hours). Graduate Seminar (PHYS 730), Selected Topics in Physics (PHYS 740), Research (PHYS 760 and 761), Dissertation Preparation (PHYS 899) and 700-level review courses do not count towards the nine hours of advanced graduate courses.

Admission to Candidacy Examination (“A to C” or Qualifying Examination)

The purpose of the Admission to Candidacy Examination is to determine whether the student is sufficiently well-grounded in the fundamental subject matter of physics, since only then will he/she be permitted to undertake a doctoral research program. The examination will consist of three written parts: Classical Mechanics, Electricity and Magnetism, and Quantum Mechanics. The test covers the material normally given in a standard physics major undergraduate program plus that in the core graduate-level courses: Classical Mechanics (PHYS 701); Classical Field Theory I and II (PHYS 703 and PHYS 704); Statistical Thermodynamics (PHYS 706); and Quantum Mechanics I and II (PHYS 711 and PHYS 712). The exam will be given only twice per year (in January and August). Passing this exam is a prerequisite to attaining the designation of “PhD Candidate” and to the submission of a dissertation proposal.

Each exam will be constructed from questions drawn from a publically available bank of questions. The bank will be available for students to peruse starting ninety days before the next examination date.

A student will be permitted no more than three attempts at taking entire exam. The first attempt, which is optional, must be made before the beginning of the student’s second year of graduate study. While the decision whether to take this “free try” or not is at the discretion of the student, it is strongly recommended; there is no risk, and it is possible the student may pass one or more sections if not the whole exam.

Students who do not complete the core 700-level courses during their first year of graduate study must take the Admission to Candidacy exam before the end of their third year and must pass the exam before the end of their fourth year.

Students who complete the core 700-level courses in their first year must take the exam before the end of their second year of study and must pass the exam before the end of their third year.

A passing grade on the Admissions to Candidacy Exam is a grade of 50%, totaled over all three sections. Students are given credit for passing individual sections of the exam if they score greater than 50% on that section and over 35% on all three sections. On the next attempt, the student is not required to retake the sections passed in previous attempts, although they have the option to do so.

The faculty may establish requirements for the candidate to fulfill during his/her PhD program to meet deficiencies that are noted during the exam. If he/she fails the final attempt, he/she cannot continue in the physics doctoral program except for special cases decided during a general faculty meeting.

After admission to candidacy and the selection of a research director (major advisor), a doctoral committee will be appointed by the research director with the approval of the Director of Graduate Studies and the Dean of The Graduate School to provide guidance and oversee the student’s program until its completion. This committee shall include at least three members of

the USC Physics faculty and one member from the faculty of another department. The committee should meet at least twice a year and report to the Director of Graduate Studies.

Residency Requirement for Doctoral Program

The residency requirement consists of 18 graduate credits in the student's program within a period of three consecutive major semesters (fall/spring). For more information, refer to the [*Graduate Studies Bulletin*](#).

Teaching Experience

Each candidate for the PhD degree must have demonstrated an ability for effective teaching. This requirement is met by service as an instructor of a laboratory or a recitation section in an elementary course in physics. These teaching assignments are supervised by a member of the faculty, and it is to the faculty member that the ability for effective teaching must be demonstrated.

Research Proposal and Comprehensive Examination

After passing the Admission to Candidacy Examination the student must prepare and defend a research proposal within six months. This time requirement is necessary for the student to maintain the status of candidate for the doctoral degree. The proposal will be written and circulated to the doctoral committee at least one week before the day of the presentation. The doctoral committee will then conduct an examination of the proposed research and on the student's general background knowledge, the latter being referred to as the Comprehensive Examination. The committee will vote to pass or fail the student on both parts of the examination and perhaps make an additional recommendation. Furthermore, the examination must be held at least one year before the dissertation defense. Students failing the comprehensive portion will be asked to repeat it at a time set by their doctoral committee. If the substance of the dissertation is markedly changed after the proposal is given, a new proposal may be required (to be scheduled not less than one year before the dissertation defense).

Dissertation

The dissertation should demonstrate that the PhD candidate has mastered the field in which he/she has chosen to do research, is capable of doing independent scholarly work, and is able to formulate conclusions that will in some respect increase the extent of and/or improve our understanding of what is already known. In order to be acceptable as a PhD dissertation, a manuscript reporting a significant part of the doctoral research results must have been submitted to a refereed research journal.

The maximum period permitted by the Graduate School for completion of the dissertation is five years after the Dissertation Proposal/Comprehensive Examination date. However, full-time physics graduate students are expected to complete their research in three years. Their progress will be reviewed every semester by their doctoral committee, and failure to make reasonable progress can result in termination of financial support.

Dissertation Defense

The completed dissertation must be defended by the student before his/her doctoral committee at an oral examination. This oral examination consists of two parts. In the first part, which is open to all department faculty members and graduate students, the student will present a summary of his/her doctoral work and entertain questions from the audience. The second part is an examination of the student's dissertation. Only members of the doctoral committee may be present during the second part. The examination committee chairman will be someone other than the research director.

A copy of the completed dissertation must be submitted to the Director of Graduate Studies and to each of the members of the doctoral committee at least two weeks before the examination, and the examination itself must take place no less than thirty days before the candidate expects to receive the degree.

AWARDS

The Department of Physics and Astronomy will award three graduate students every year - one for teaching, one for research, and one for service. The award amounts are \$1000 each.

Every year, one graduate student will be awarded the Physics and Astronomy Graduate Student Teaching Award based on performance in teaching and grading of physics and astronomy courses. Nominations for the award can be made by any member of the department faculty and should be accompanied by a written endorsement of the candidate. Comparative evaluations of GTAs from the laboratory manager, the professor in charge of labs, and other teaching faculty will play an important role in deciding who receives the award. The recipient will be chosen by the Department Chair and the Director of Graduate Studies in consultation with appropriate personnel.

Every year, one graduate student will be awarded the Physics and Astronomy Graduate Student Research Award based on research performance. Nominations for the award can be made by any member of the department faculty and should be accompanied by a written endorsement of the candidate. Publications submitted by a student and/or other concrete evidence of research achievements will play an important role in deciding who receives the award. The recipient will be chosen by the Department Chair and the Director of Graduate Studies in consultation with appropriate personnel.

Every year, one graduate student will be awarded the Physics and Astronomy Graduate Student Service Award based on service and volunteer work. Nominations detailing the student's contributions can be made by any member of the department faculty and should be accompanied by a written endorsement of the candidate, which will play an important role in determining who receives the award. The recipient will be chosen by the Department Chair and the Director of Graduate studies in consultation with appropriate personnel.

Students past their fifth year of graduate studies (second year for MS students) are automatically ineligible for the awards.

GRADUATE COURSE DESCRIPTIONS

The Department of Physics and Astronomy offers programs in physics leading to the degrees of Master of Science and Doctor of Philosophy. Research opportunities are currently available in theoretical physics, general relativity, astrophysics, experimental and theoretical hadronic physics, high energy physics, neutrino physics, chemical physics, experimental and theoretical solid state physics, magnetic resonance, magnetic properties, cryogenics, transport properties, high temperature superconductivity, and computational physics. A complete list of course descriptions can be found in the [*Graduate Studies Bulletin*](#).