

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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Department of Physics and Astronomy Graduate
Student Handbook
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Table of Contents

Expected Undergraduate Background	2
Course Registration and Academic Advisement	2
General Issues	3
Sequence of Events	4
Sequence of Events for MS Degree	4
Sequence of Events for PhD Degree	4
Master of Science Requirements	4
Summary of Requirements	4
Coursework	5
Thesis	5
Comprehensive Exam	5
Thesis Defense	5
Doctor of Philosophy Requirements	5
Summary of Requirements	6
Coursework	6
Admission to Candidacy Exam	7
Doctoral Committee	8
Residency Requirement for Doctoral Program	8
Teaching Experience	8
Research Proposal and Comprehensive Examination	8
Dissertation	9
Dissertation Defense	9

Awards	10
Graduate Course Descriptions	11
Grievance Procedures	11

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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 full-time teaching assistants are expected to spend 20 hours per week on teaching duties, as per university policy. Part-time teaching assistants are expected to spend the corresponding fraction of 20 hours per week on teaching duties.
- 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.
- TA appointments are renewed on a semester basis. Continuation of the assistantship is contingent upon satisfactory performance in the assigned TA duties, satisfactory academic progress, and availability of funds.
- 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.
- Courses graded D+ or lower cannot be applied to graduate degree programs.

- 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 composed of questions drawn from a publicly available bank of questions. The bank will be available for students starting ninety days before the next examination date.

Students will be permitted no more than two official attempts at taking the exam. Prior to the first official attempt, an optional “free try” may be taken before the beginning of the student’s second semester of 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 that the student may pass one or more sections if not the whole exam.

Students must take the exam at the first available opportunity after completing the 700-level courses (PHYS 701, 703, 704, 706, 711, and 712). If the courses are not completed within the first four semesters, the first attempt must still be made before the student’s third year. If all sections are not passed on the first attempt, the second attempt must be made at the next regularly scheduled administration of the exam.

A passing grade on the Admissions to Candidacy Exam is a grade of 50%, totaled over all three sections. On the first attempt, students are given credit for passing individual sections of the exam if they score greater than 50% on that section, provided that they score over 35% on all three sections and, in the view of the Admission to Candidacy Committee, have made a definite effort to pass all the 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.

Doctoral Committee

The doctoral committee provides research guidance and oversees the student's program until its completion. The doctoral committee consists of a minimum of four members: at least three members of the USC Department of Physics and Astronomy faculty and one outside member. According to the Graduate Bulletin, the outside member may be a regular or associate member of the graduate faculty in another department/program at USC, a faculty member from another institution, or a qualified professional from the private or governmental sectors. The student must select a research advisor (major professor) within six months of passing the Admission to Candidacy Examination. The research advisor will be one of the members of the doctoral committee. The remaining committee members will be chosen by the student in consultation with the research advisor. The doctoral committee is appointed by the Graduate School at the request of the student, with the approval of the Graduate Director. It must be appointed prior to the Research Proposal and Comprehensive Examination.

The committee members will choose a chairperson in consultation with the Director of Graduate Studies. The committee chairperson will be someone other than the research advisor and will chair the Research Proposal and Comprehensive Examination and the Dissertation Examination.

Residency Requirement for Doctoral Program

The residency requirement may be met by two consecutive semesters of full-time enrollment. 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

To maintain the status of candidate for the doctoral degree, the student must write a dissertation proposal and defend it during the Comprehensive Examination within one year of passing the Admission to Candidacy Examination. The student must submit the written proposal to the doctoral committee at least one week before the day of the Comprehensive Examination. Furthermore, the Comprehensive Examination must be held at least one year before the dissertation defense.

The written proposal should outline the student's plans for their dissertation research and place it in the context of the relevant subfield. It is not intended to be a preliminary version of the dissertation. While the content should be determined in collaboration with the major professor and the other members of the doctoral committee, the proposal should typically include (but is not limited to):

- A brief introduction to the research topic that highlights the goals of the proposed research.
- A background section that motivates and places the proposed research in the context of the relevant subfield.
- A description of the proposed research, including a discussion of the methods and techniques to be used.
- A conclusion/outlook.
- A bibliography with relevant references.

The student is encouraged (but not required) to format the written proposal following the University's dissertation format guide. The presentation slides used for the Comprehensive Examination may not be submitted in place of the proposal.

The purpose of the Comprehensive Examination is to assess whether the proposed research plan is scientifically sound and feasible, and to determine whether the student has the necessary knowledge and skills to carry out the planned research successfully. The Comprehensive Examination will start with a short presentation by the student, designed for approximately 30 minutes in the absence of interruptions. The doctoral committee will then conduct an examination of the proposed research and of the student's general background knowledge in the relevant subfield. Immediately following the examination, the committee will vote to pass or fail the student and make additional recommendations if required.

Students failing the Comprehensive Exam 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.

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](#).

GRIEVANCE PROCEDURES

The Graduate School has established grievance procedures for students. Students should consult the current [Graduate Studies Bulletin](#), as well as the official University of South Carolina policies, [STAF 6.27](#) (Student Grievance Policy – Non-Academic) and [STAF 6.30](#) (Academic Grievance Policy).

Prior to submitting a grievance at the university level, we recommend that students first seek a resolution at the departmental level. The student may choose to seek a resolution directly with the other involved individual(s). If this is not appropriate, or no satisfactory resolution is achieved within ten business days, the student may pursue the matter further with the Director of Graduate Studies (unless the Director is directly involved with the grievance). If the situation is still not resolved, the student should then consult the Department Chair (again, unless the chair is already directly involved). If the student is unsatisfied with the departmental response, he/she may then submit an appeal in writing to the College of Arts and Sciences Associate Dean for Research and Graduate Education. If the student remains unsatisfied with the results, he/she may submit the grievance to the Graduate School in accordance with their policies and procedures.