

# **BYLAWS OF THE GRADUATE PROGRAM IN PHYSICS**

## **I. Preamble**

These Bylaws establish basic operating procedures for the Graduate Program in Physics, subject, to the regulations of Rutgers University and the Graduate School—New Brunswick. The final authority for all matters of interpretation and implementation of these Bylaws shall rest with the Graduate Program Faculty.

## **II. Graduate Program Director**

The Graduate Program Director will be appointed by the Dean of the Graduate School upon the recommendation of the Chairperson of the FAS Department of Physics and Astronomy (hereinafter called “department”). The term of office will be negotiated at the time of appointment or reappointment. The Graduate Program Director will have general responsibility for the administration of the Graduate Program and for representing the Program in consultations with the Graduate Dean and other members of the Administration.

## **III. The Graduate Program Faculty**

The Graduate Program Faculty shall consist of all members and associate members of the Graduate School Faculty with primary appointments in the Department of Physics and Astronomy. Additionally, the Graduate Program Faculty (hereinafter called “faculty”) may by majority vote elect members and associate members with primary appointments in other departments.

Members and associate members of the faculty shall be nominated by the Graduate Program Director and appointed by the Dean of the Graduate School in accordance with the Bylaws of the Graduate School. Newly appointed tenured and tenure-track faculty shall normally be nominated as members.

## **IV. Graduate Program Meetings**

Meetings of the faculty may be called by the Department Chairperson, or by the Graduate Program Director, or by a petition signed by six faculty members. One-half of the faculty shall constitute a quorum. Meetings shall normally be open to faculty members, postdoctoral research fellows, and graduate students in the Program, but only the faculty members shall be entitled to vote. When matters involving individual students and personnel are being considered, the meeting shall normally be open only to faculty members. Minutes and attendance at meetings will be taken by the Graduate Program Administrative Assistant.

## V. Committees

All committees shall be appointed annually with some regard to maintaining reasonable continuity in committee composition. All committees shall keep the faculty informed of work in progress and action under consideration, and shall bring recommendations to the faculty as appropriate.

- A. The Responsibilities Committee of the department shall advise the department chairperson on all teaching and committee assignments to faculty members in accordance with department bylaws. The committee shall consist of the Department Chairperson, the Graduate Program Director, the Undergraduate Coordinator, at least one full professor, at least one associate professor, and at least one assistant professor.
- B. The Graduate Studies and Life Committee (GSLC) shall supervise the operation of the graduate program, including advising graduate students, considering complaints, problems, and suggestions, recommending changes in the program, and recommending changes in the status of individual students. Membership shall consist of the Graduate Program Director (chair), the graduate student advisers, and two graduate students, the President and Vice-President of the Graduate Student Organization, if willing, or selected by the Graduate Director by seeking volunteers, if not. The Graduate Director, with the advice of the graduate advisers, shall award teaching assistantships, graduate assistantships, fellowships, and coadjutant positions.
- C. The Graduate Admissions Committee shall examine the applications for admission to the Graduate Program. Based on available material, including Graduate Record Examination (GRE) scores, the Test of English as a Foreign Language (TOEFL), undergraduate records, letters of recommendation, and interview reports, the committee shall recommend offers of full-time, part-time, or non-matriculated admission to appropriate applicants. The committee shall also recommend the type of support (e.g. fellowship, teaching assistantship) for each full-time offer, and shall normally avoid offering full-time admission without support. GRE scores for the Aptitude Test as well as the Subject Test in Physics (or an alternative acceptable to the Graduate Studies and Life Committee) shall normally be required of all degree applicants.
- D. The Graduate Recruiting Committee shall prepare suitable announcements, posters, and brochures to solicit applications to the graduate program. The committee shall also attempt to recruit applicants to whom offers have been made, especially by arranging guided visits to Rutgers whenever feasible. There will be one graduate student member of the recruiting committee, determined via elections organized by the Graduate Student Organization, or selected by the Graduate Director by seeking volunteers if no election is held.

- E. The Ph.D. Qualifier Committee shall be responsible for the administration, grading, and analysis of the Ph.D. candidacy examination. The Ph.D. candidacy exam consists of a research project leading to a written paper, presentation, and questioning. The Qualifier Committee evaluates the candidate, who must independently pass each of the three components. Normally each examination shall be conducted by three committee members plus the student's mentor. The student will be judged on their understanding of the advanced and underlying material and on the quality of their paper and presentation. Each section may be passed by a majority vote of the three committee members.
- F. Other committees may be created at the discretion of the Responsibilities Committee and given mandates to deal with specific tasks.

## **VI. Program Descriptions and Degree Requirements**

The Rutgers Department of Physics and Astronomy offers several advanced degree programs in physics as described below. The Graduate Program Director will advise students on course selections and sign all the appropriate forms. Consultation with a faculty advisor about more general physics topics is encouraged.

### **A. DOCTOR OF PHILOSOPHY DEGREE (Ph.D.) IN PHYSICS**

The purpose of this degree program is to broadly train students in the fundamentals of physics and in the analytical techniques of the physicist. A thesis of original research is required to give the students experience in bringing themselves up to the frontier of an important area of physics.

A total of 72 credits are required, of which at least 24 must be in research. No minimum number of course credits is specified, but certain courses are required.

#### **1. Examination Requirements**

##### **a. Ph.D. Candidacy Examination:**

All prospective candidates normally take the Ph.D. candidacy examination after the equivalent of one year of graduate work. Physics students are generally required to take the examination at least by the beginning of the semester after successfully completing with a grade of B or

better Quantum Mechanics 501-502, Electricity and Magnetism 503-504, Classical Mechanics 507, and Statistical Mechanics 611, or their equivalents, or by the beginning of their second year, whichever occurs later. Students transferring into the graduate program with advanced standing may be required by the Graduate Studies and Life committee to take the examination earlier. In very unusual situations the Ph.D. candidacy examination may be delayed with approval of the Graduate Director. The Ph.D. candidacy exam is briefly described in Section V.E.

Students who do not successfully pass the Ph.D. candidacy exam will normally be given a chance to repeat the failed portions of the exam, but the students are generally required to complete the exam by the end of their second year of graduate school, or else leave the program. Students will be informed of the result of their qualifier exam, normally within one day after the decision. Students who are not advanced to candidacy should speak to the Graduate Program Director, who will explain the reasons for the faculty's action. A student who feels that the negative decision was unjustified should follow the appeals procedure described in Section V1.A.6.

b. Ph.D. Final Examination:

The Ph.D. final examination is a public defense of the candidate's Ph.D. thesis. It is administered by the candidate's Ph.D. committee (whose composition is described in Section V1.A.3) and is open to the public. The defense typically takes the form of a seminar, in which the student presents the background, development, and results of the research. Frequent questions explore these and related areas, and may also probe the breadth of the candidate's knowledge in other areas of Physics.

The thesis itself must be a clearly written account of original research. In addition to a description of the details and results of the research, it should contain an appropriate general and historical introduction, written at a level understandable by most second-year graduate students. The quality of the writing must be comparable to that found acceptable for publication in the standard journals. The thesis must be submitted to the committee members at least two weeks prior to the date of the final examination, and it must be complete, but need not be in final form suitable for publication.

After the examination is complete, the committee will meet in closed session to evaluate the student. The committee shall decide i) to pass the student, or ii) to pass the student on the understanding that certain specified changes or elaborations will be made in the dissertation, or iii) to fail the student. A decision to pass the student shall require a unanimous vote. The committee will immediately recall the student and disclose its decision. If the decision is to fail,

the committee will explain its reasons. A student shall be allowed one more attempt to pass at a future date.

A failing student who feels that the committee's decision was unjustified should follow the appeals procedure described in Section V1.A.6.

## 2. Course Requirements

Physics students are required to pass with a grade of B or better the core courses 502 Quantum Mechanics, 504 Electricity and Magnetism, 507 Classical Mechanics, and 611 Statistical Mechanics. 501 Quantum mechanics is a pre-requisite for 502, and 503 Electricity ; four advanced graduate courses which will include two courses outside of the area of research. (It is understood that students will take appropriate lower level courses if necessary to prepare themselves for these.) In addition, 511 Math Physics and 506 Modern Experimental Techniques are strongly recommended for each candidate. Students may continue after their first year only if they have received at least two grades of B or better in their first year courses.

## 3. Research Requirements

It is the student's responsibility to talk with members of the faculty and to learn of their research interests and hence to select a research advisor by mutual agreement. Students are encouraged to begin this process early in their careers here. After reading about the research programs of individual faculty in the Graduate Student Handbook and, possible, discussion with senior graduate students and their current faculty advisor, students should systematically discuss possible research topics and opportunities with individual faculty members in their chosen area. Such discussions are also appropriate before choosing a research area. It is useful to note that, while the initial choice of advisor is clearly important, it is not binding; either student or advisor may decide that a change in advisor may be appropriate.

Once a research advisor has been chosen (and the student has been admitted to Ph.D. candidacy), the Graduate Director will appoint a Ph.D. committee with four members. Additional members may be appointed, especially if the student's work is relevant to more than one field of inquiry. The committee chairperson is usually the student's research adviser. The other committee members will normally be faculty members with expertise in the student's general area of physics research, except that one member will usually be from another area. Most physics research is categorized as theoretical or experimental. Most committee members will be specialists in the same category as the student, but one member will normally be from the other category. The committee exists to regularly help the student in research, and to monitor progress toward the degree on a periodic basis. Committee meetings take place at least once a year; students obtain the appropriate summary forms (a part of which must be completed before the meeting) from the graduate administrative assistant. During the meeting, the students make a

well-planned oral presentation of the successes and failures of their research; this presentation should be comparable in quality to a talk before a professional society. In addition to possible technical improvements in the research, committee discussion explores the students' breadth of knowledge in their research area. The committee will provide a written assessment of the student's progress. In cases of unsatisfactory progress, the committee may recommend warnings or termination of studies in accordance with the procedures of the Graduate School. A student or member of the committee can request that the committee convene at any time for discussion of progress. Finally, it is the Ph.D. committee which administers the final examination and approves the thesis.

The normal time required for completion of the Ph.D. degree is from 5 to 6 years of full-time graduate study. Full-time students may not continue for more than 7 years without special permission from the graduate school. Students not maintaining satisfactory course or research progress may be required to withdraw from the program by vote of the faculty. In such cases, the procedures to be followed shall be those specified in the Catalog of the Graduate School in the section on termination of studies.

#### 4. English Language Studies

Students whose native language is not English may be required to take courses in the Program in American Language Study (PALS). Satisfaction of these requirements is an important aspect of study here, and failure to do so in timely fashion may result in loss of financial support. Summer teaching assistantships are generally not available to students who have not passed the PALS exams. It should be noted, moreover, that these are minimum standards, and that further efforts to improve communication skills may be appropriate and required.

#### 5. Seminars and Colloquia

Every Wednesday afternoon at 4:30pm., the departmental colloquia are held. All graduate students are expected to attend as part of their regular graduate program. Normally, an outside speaker is invited to talk about new developments in a particular area of physics, but at a level intelligible to non-specialists. There are also specialized weekly seminars in astrophysics, condensed matter physics, nuclear physics, and elementary particle physics, and students who have begun research are expected to attend the seminar in their field.

#### 6. Grievances and Appeals

Students have the right to appeal actions of individual faculty members or the graduate program, including but not limited to academic matters, such as grades assigned, advancement to Ph.D. candidacy, and decisions of final examination committees, and non-academic matters, such as teaching assignments for TAs. Generally the student should discuss the matter first with the relevant faculty member or committee. If the matter cannot be resolved to the student's satisfaction, the student may appeal to the Graduate Program Director, who will attempt to resolve the situation. The decision of the Graduate Program Director may be appealed to the Graduate Studies and Life Committee. The decision of the Graduate Studies and Life Committee may be appealed to the Dean of the School of Graduate Studies or their designee.

Appeals should be made within 30 calendar days; university policies or schedule considerations such as degree deadlines and class schedules may affect the resolution of the matter even if the appeal succeeds. Appeals to the Graduate Program Director or the Graduate Studies and Life Committee should be in writing, either by mail or email.

If the appeal concerns actions originally taken by the Graduate Program Director or a member of the Graduate Studies and Life Committee, those individuals shall recuse themselves from a vote of the Graduate Studies and Life Committee.

## B. MASTER OF SCIENCE DEGREE

There are two options for the Master of Science degree: with essay and with thesis. For both options up to 12 credits can be at the upper level (300 or 400 level) undergraduate courses taken at Rutgers while in the graduate program. Up to 12 credits may be transferred from another institution. Transfer credits must be at the graduate level. For transfer of graduate courses taken as an undergraduate, a letter is required from the registrar of the institution involved stating that the course or courses were not used toward an undergraduate degree. No more than 9 credits with grades of C or C+ may be used toward the degree.

### MS with Essay

The MS with essay is a course based Master's degree. Course selection should be chosen in consultation with the Graduate Program Director. 30 credits of course work is required for the degree. Non course-work based credits, such as the seminar in physics, and research credits, cannot be counted toward the degree. Generally no fewer than 24 credits in physics, astronomy or closely related fields, of which no more than 12 credits may be at the advanced undergraduate level, are required. The essay may be based on material from a regular physics course, Physics 699, or on a research project.

### MS with Thesis

The MS with thesis requires 30 credits, of which at least six credits must be in research. In addition, no fewer than 18 course credits must be in physics, astronomy or closely related fields.

No more than 6 credits may be at the advanced undergraduate level. Non course-work based credits, such as the seminar in physics, cannot be counted toward the degree.

### MS Examination

The M.S. examination is an oral comprehensive examination covering the fundamentals of the courses taken by the student in the program and, in the case when a thesis is submitted, over the thesis material. No M.S. exam is required for students who have been advanced to candidacy for the Ph.D. or have passed the oral component of the qualifying examination, and do not submit a thesis. Students failing the examination on the first attempt will be permitted one more attempt. The examination is to be administered by the student's M.S. committee. This consists of three faculty members appointed by the Graduate Program Director, one of whom is normally the M.S. coordinator. When courses have been taken outside of physics, the committee should contain a faculty member from the appropriate discipline.

consent of the committee members. Students who dispute the committee's decision may follow the same appeal procedure described previously for doctoral students.

### C. MASTER OF PHILOSOPHY (M. Phil.) DEGREE

The Graduate Studies and Life Committee will consider requests from Physics graduate students for the Master of Philosophy degree. The committee will generally observe the following guidelines:

1. The M. Phil. Degree is intended for students who have been advanced to candidacy for the Ph.D. degree, and who have achieved records of distinction during the predissertation phase of the program.

2. To qualify for the M. Phil. Degree, a student must have completed at least 48 credits, of which at least 33 must be in courses numbered at the 500 and 600 levels. All the course requirements for the Ph.D. must have been satisfied. The student's grade point average must be at least 3.5 in regular classroom courses.

3. The student must have achieved a score of at least 65% on the written Ph.D. Qualifying Exam, and an outstanding performance on the oral exams.

4. The student must meet the writing requirement for the Master of Science (M.S.) degree, i.e. either a Master's thesis or an essay normally based on material from a graduate course. A thesis or essay that has been submitted for the M.S. degree may also be used for the M. Phil. Degree.

5. No oral comprehensive examination will be required; passing the Ph.D. Qualifying Examinations will be considered the equivalent.

#### D. MASTER OF SCIENCE FOR TEACHERS (MST) DEGREE

The M.S.T. degree is primarily for practicing teachers, although others may be accepted. The requirements for the M.S.T. degree in physics consist of 30 credits, a comprehensive examination, and an essay or thesis.

1. The courses are chosen in consultation with the departmental adviser to fit the needs of the individual student. Their principal aim is to give each candidate the opportunity to learn more physics. Both undergraduate and graduate courses may be used, depending on the person's previous experience.
2. Each candidate must demonstrate competence in the basic subjects of mechanics, electromagnetism, thermodynamics, atomic and nuclear structure, and calculus at a comprehensive M.S.T. examination. The examination is normally oral, and is administered by a committee of three members of the faculty appointed by the Graduate Program Director.
3. To the extent that a student has satisfied the basic physics requirements as preparation for the comprehensive examination, he or she may select courses in physics, other sciences, mathematics, or in education.
4. No more than nine credits with grades of C may be accepted toward the M.S.T. degree. Up to twelve credits may be transferred from other institutions with approval of the department and the Graduate School.

The M.S.T. critical essay is generally a review of a particular area of physics, resulting from specialized study. It may also describe the results of a candidate's development of a novel teaching unit, including perhaps a laboratory experiment. An M.S.T. candidate may elect to submit a regular M.S.T. thesis for which six credits may be earned through research rather than in courses. The research may be in theoretical or experimental physics, or it may be primarily pedagogical in nature. The research must be supervised by a member of the faculty with the advice of the candidate's committee and a final defense of the thesis work will be held before the candidate's committee.

#### E. NON-MATRICULATED STUDENTS

A student may take any of the regular courses offered by the physics department or any of the special evening courses upon admission to the graduate school as a non-matriculated student. Such courses may later be applied toward any of the regular degree programs if the student is admitted as a candidate for such a degree. Students applying for non-matriculated status should submit a transcript of their undergraduate grades and one letter of recommendation along with their application; GRE tests are not required. Students who subsequently desire to join a degree program should make their request to the Graduate Program Director, who will make a decision with the advice of the Graduate Studies and Life Committee. The student will normally be

required to submit scores on the GRE Aptitude Test and Subject Test in Physics before a decision is made.

## **VII. Enactment and Amendments**

These bylaws shall be enacted and amended by a simple majority of votes cast at a meeting of the Graduate Program Faculty.

Last revised 2/2018