

GRADUATE STUDENT HANDBOOK

Department of Physics & Astronomy, University of Delaware 2017

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I. Introduction

The [Department of Physics and Astronomy](#) (DPA) offers a graduate program leading to the M.S. or Ph.D. degrees in Physics. This handbook provides an outline of the requirements for these degrees. Many aspects of graduate work at the University of Delaware are covered by University regulations and can be found in the [Academic Regulations for Graduate Students](#) which is part of the [Graduate Catalog](#).

Nearly all graduate students in the program are at some point or another supported as Teaching Assistants (TAs). Valuable information about being a TA can be found in the [Handbook for Graduate Teaching Assistants](#), issued by the Center for Teaching and Assessment of Learning. This handbook also provides a convenient [summary of University policies](#) that apply for the appointment of Graduate Teaching Assistants.

II. Degree requirements

M.S. Degree

Students may choose to obtain an M.S. degree with or without thesis:

The **M.S. with thesis** degree requires **24 credits hours** of graded PHYS courses, including at most 3 credits of research (PHYS 868). **Graded courses are those receiving a letter grade (A through F). Among 24 required credits, at least 6 credits must be at the PHYS 800 level.** In addition, 6 credits of thesis work (PHYS 869) are required. The purpose of the M.S. thesis is to demonstrate that the student can conduct research under supervision and communicate the results clearly in English. The thesis is defended in an oral examination administered by a committee of three members of the Department.

The **M.S. without thesis** degree requires **30 credit hours** graded PHYS courses, including at most 3 credits of research (PHYS 868). **Graded courses are those receiving a letter grade (A through F). Among 30 required credits, at least 6 credits must be at the PHYS 800 level.** In addition, the degree candidate will survey the literature on a current topic in physics or astronomy, write a report on this topic and make a public presentation to the Department, represented by three members of its faculty (appointed by the Director of the Graduate Program with approval of the Chair of the Department).

Approval of the graduate review committee is required if more than 6 credits are from Departments other than Physics and Astronomy or if any are in a discipline unrelated to physics.

Ph.D. Degree

Students may enter the Ph.D. program after successfully completing an M.S. degree program, at the University of Delaware or elsewhere, or may be admitted directly to the Ph.D. program directly after a Bachelor's degree. To obtain a Ph.D., students will normally follow the course intensive **regular track**. Students entering the program with at least a U.S. Master of Science degree, or its equivalent, in Physics or a closely related field may be eligible to follow the less coursework intensive **fast track**. Eligibility for the fast track will be determined by the DPA Graduate Admissions Committee.

Course requirements for regular track students

Students on the **regular track** must satisfy the following course requirements:

Taking and passing, with an average grade of 3.0 or better, 30 credits of *graded course work* within the first five semesters after entering graduate school. Graded courses are those receiving a letter grade (A through F). Among 30 required credits, students *must* take 5 core courses (15 credits total):

PHYS 809: Electrodynamics I

PHYS 810: Electrodynamics II

PHYS 811: Quantum Mechanics I

PHYS 812: Quantum Mechanics II

PHYS 813: Quantum Statistical Mechanics

and pass each of them with a grade of B- or higher. If a student fails to obtain a B- or higher grade for a core course, the particular course in question must be repeated once again and the student must acquire a passing grade of B- and above.

In addition, among 30 required credits students should select one "practical skills" course (3 credits total) from:

PHYS 646: Advanced Lab

PHYS 660: Computational Methods of Physics

Finally, among 30 required credits students should select one 600-level and one 800-level specialized course of relevance to their intended field of research (6 credits total) from the following two clusters of courses.

Students intending to pursue Ph.D. in Astronomy & Astrophysics; Particle Physics; Space Physics; or any crossover area between them should select one 600-level and one 800-level course from:

PHYS 633: Introduction to Stellar Astrophysics

PHYS 635: Space Physics

PHYS 644: Elementary Particles & Big Bang Cosmology

PHYS 815: General Relativity

PHYS 822: Quantum Field Theory

PHYS 834: High Energy and Particle Astrophysics

PHYS 835: Laboratory, Space and Astrophysical Plasmas

Students intending to pursue Ph.D. in Atomic, Molecular and Optical Physics; Condensed Matter & Materials Physics; or any interdisciplinary area involving research at the Departments other than Physics & Astronomy should select one 600-level and one 800-level course from:

PHYS 624: Introduction to Condensed Matter Physics

PHYS 626: Introduction to Atomic, Molecular and Optical Physics

PHYS 655: Statistical Biophysics

PHYS 806: Atomic, Molecular and Optical Physics

PHYS 814: Advanced Quantum Mechanics

PHYS 824: Nanophysics and Nanotechnology

Students who decide to change their field of research must satisfy the requirement above for their new field of research.

First year students are required to take the following one credit courses:

PHYS 600: Research and Presentation Skills

PHYS 601: Introduction to Teaching Physics and Astronomy

Note that PHYS600, PHYS601 and PHYS699 are evaluated as Pass/Fail, and therefore are not considered as graded and do not count into 30 credits of graded course work.

Course credit earned at the University of Delaware to obtain an M.S. in Physics may be applied toward the doctoral degree. Students on the regular track may, with approval of the Graduate Review Committee, apply graduate course credits earned elsewhere, but not used to obtain a previous degree, toward the doctoral degree to a maximum of 9 credits.

Course requirements for fast track students

Students following the *fast track* must meet the following minimum requirements:

1. In consultation with and with approval from the Director of the Graduate Program, the student will identify **four** 3-credit 800-level classroom courses (12 credits total) to be taken in their first year in the graduate program. Each of these courses must be passed with a grade of B or better (*not B-*). Students may take additional courses.
2. Students must take the Written Candidacy Exam on entering and pass it then, or by the beginning of the second semester in the graduate program, to remain on the fast track.

All second year students are required to take one credit course **PHYS 699: Physics and Astronomy Colloquium (in both the Fall and the Spring semesters)**. **All** students in the Ph.D. program are required to complete 9 credits of doctoral dissertation (PHYS 969).

Ph.D. Candidacy Exams

The Written Candidacy Exam

All students in the Ph.D. program must pass the Written Candidacy Exam (WCE) *before the beginning of their fourth semester in the graduate program*. If a student on the fast track has not passed the WCE before beginning their second semester in the program, they will move to the regular track.

The exam will be given twice a year, in late August and in late January/early February. The exam will be graded as a whole and will consist of 4 sections, each with 4 problems. The sections of the exam and the textbook and associated material from which that section will be based are:

- *Classical mechanics*—covering chapters 7-11 and 13-14 in J. R. Taylor, "Classical Mechanics."
- *Electricity and Magnetism*—covering all material in D. J. Griffiths, "Introduction to Electrodynamics," 3rd edition.
- *Thermodynamics and Statistical Mechanics*—covering chapters 1-9 in W. Greiner, L. Neise and H. Stöcker, "Thermodynamics and Statistical Mechanics."
- *Quantum Mechanics*—covering chapters 1-8 in D. J. Griffiths, "Introduction to Quantum Mechanics," 2nd edition.
- *Special relativity problems*, if any, will only appear on the Electricity and Magnetism section of the exam.

The Oral Candidacy Examination

The purpose of the Oral Candidacy Exam (OCE) is to show that the student has a clear research plan with a path to its completion, has a general understanding of the research topic and can put it in context in the broader field of research. *Before the beginning of their sixth semester in the graduate program*, a Ph.D. candidate must make an oral presentation to a committee consisting of the local members of the Ph.D. dissertation committee and two additional members appointed by the Director of the Graduate Program. A member of the OCE committee other than the dissertation adviser of the Ph.D. candidate will be appointed committee chair by the Director of the Graduate Program. A student who fails the OCE has one opportunity to retake the exam. This has to take place within 6 month of the original examination.

Standard Schedule of Courses and Candidacy Exams

Standard schedule for Ph.D. students on regular track in the first five semesters of studies:

	Fall	Winter	Spring
Year 1	Graded courses: PHYS607, PHYS616, PHYS620 One credit courses: PHYS601		Graded courses: PHYS603, PHYS811, PHYS660 or PHYS646 One credit courses: PHYS600
Year 2	Graded courses: PHYS809, PHYS812, PHYS600-level specialized course One credit courses: PHYS699	Written candidacy exam passed	Graded courses: PHYS810, PHYS813 One credit courses: PHYS699
Year 3	Graded courses: PHYS800-level specialized course Research courses: PHYS868	Oral candidacy exam passed	

Standard schedule for Ph.D. students on fast track in the first two semesters of studies:

	Fall	Winter	Spring
Year 1	Graded courses: Two PHYS800-level courses One credit courses: PHYS601	Written candidacy exam passed	Graded courses: Two PHYS800-level courses One credit courses: PHYS600

Regulations for students who change adviser after passing the OCE

Students who change dissertation adviser after having passed the OCE are required to give, within 6 months of changing adviser, a written progress report and an oral presentation to the Graduate Review Committee, who will make a funding recommendation based on their evaluation of the progress report and oral presentation.

Ph.D. Dissertation

Upon successful completion of a research program, the Ph.D. candidate will write a dissertation showing originality of thought and scholarship, properly expressed in English. The dissertation is defended in an oral examination administered by the student's dissertation (doctoral) committee (see below). The committee may require that changes or revisions be made to the dissertation. The final oral examination is not considered to have been passed until the dissertation revisions have satisfied the committee. In general, doctoral committees should strive to achieve consensus concerning the student's performance and quality of work. In the case of dissenting votes, the majority opinion rules and a majority vote in favor is needed for a successful defense.

Role of the Ph.D. committee

Within six months of passing the written part of the Ph.D. Candidacy Examination, the candidate, together with his/her advisor, should decide upon the composition of the dissertation committee.

The Ph.D. candidate should provide the members of the Ph.D. committee with an annual report (due May 15) outlining the progress made and plans for the following year. At least six months prior to the anticipated defense of the dissertation, the candidate will make a careful written and oral presentation to the dissertation committee, which may advise upon the final stages.

Composition of the Ph.D. committee

It is the policy of the University's Graduate Program that each dissertation committee will consist of between four and six members:

- At least one committee member will be drawn from an academic unit other than the Department of the advisor, or from an institution or organization external to the University.
- The chair of the committee is the faculty member in charge of the candidate's research and dissertation.
- At least one member of the committee will be a member of the DPA faculty from a research area distinct from that of the candidate. For this purpose, the

distinct research areas are: 1) Astronomy & Astrophysics; 2) Atomic, Molecular and Optical Physics; 3) Condensed Matter & Material Physics; 4) Particle Physics, and 5) Space Physics.

- At least one member of the committee will be from the DPA faculty.
- The members who satisfy the various requirements need not be distinct.

III. General rules of the program

Enrolment

In order to remain in good standing in the DPA graduate program, each full-time Master's candidate must take at least six credit hours of 600 or 800 level PHYS courses during each semester, maintaining in these PHYS credit hours a cumulative GPA of 3.0 or better, until he/she has fulfilled the course requirements for the Master's degree. Ph.D. candidates must continue taking six or more credit hours of 600 or 800 level PHYS course work in each semester until they have passed the written part of the WCE, maintaining in these PHYS credit hours a GPA of 3.0 or better.

Courses designated as Pass/Fail and courses in research or in thesis/dissertation do not satisfy the six PHYS credit hour per semester course requirement and are not considered in computing the required grade point average.

In addition, the following rules apply:

- Approval of the Graduate Review Committee is required if more than six classroom credit hours are from Departments other than Physics and Astronomy, or for any credit hours in a discipline unrelated to Physics.
- First year students will register for PHYS 600/800 courses only.
- All full-time first-year graduate students who have not yet passed the WCE are required to take for credit in their first year at least 5 classroom PHYS courses at the 600- or 800-level.

Advisement

The Director of the Graduate Program functions as the initial advisor for the first year students. Students are encouraged to select a research advisor early, and must formally identify one (subject to possible change later) by May 15 to be eligible for financial support during summer. **They are assisted in their choice of research area and research advisor by a one credit Pass/Fail course PHYS 600.** Students are also encouraged to broaden their awareness of current research by attending the DPA colloquia, seminars and graduate student research talks.

Progress towards a graduate degree

A reasonable goal for a well-prepared graduate student is the completion of an M.S. degree within 2 years from the time of first entering graduate school, and the completion of a Ph.D. degree within 2 to 4 years if the student enters with an M.S. or 4 to 6 years when entering with a Bachelor's degree. In order to extend support beyond these time limits, the Graduate Student Review Committee must take positive action. It is in the student's interest to complete a degree as soon as possible insofar as is consistent with work of good quality. Thus every effort is made to encourage a student and his or her advisor to design a degree program which can be completed within these time limits. In the event that extensions of support are needed, a student and his or her advisor should submit a written request to the Graduate Review Committee as soon as the need for extra time becomes clear.

Students who fail to pass the WCE within 1½ years may request transfer to the M.S. program, as may those who fail to pass the OCE.

The Graduate Review Committee meets immediately after the end of Spring semester to examine the time table for all students. The committee reviews their status regarding progress and financial support, and thereupon provides written reports to the students, their research advisers and to the Director of the Graduate Program.

Good academic standing

To be considered in good academic standing, a student must maintain a minimum cumulative graduate grade point average (GPA) of 3.00 on a 4.00 scale each semester. To be eligible for an advanced degree, a student's cumulative grade point average shall be at least a 3.00. *A grade below a C- will not be counted toward the course requirements for a degree but is calculated in the student's cumulative grade point average.*

Arbitration

In those instances in which difficulties arise in communications between a student, the advisor, and/or the Graduate Review Committee, informal consultation with the Director of the Graduate Program may be helpful. Should this avenue fail to restore healthy communication, the matter may be considered by the entire Graduate Studies Committee.

IV. Graduate student teaching and financial support

Students who are awarded fellowships or assistantships assume a contract with the University. The University agrees to provide a scholarship for the student's tuition and pay a stipend. As with any professional appointment, the amount of service may vary but the average is usually expected to be 20 hours per week. Continuation of the appointment

is contingent upon satisfactory performance of assigned duties, continued academic eligibility and compliance with the University's [Code of Conduct](#).

Eligibility for financial support

The University will not permit support of a student who has not obtained a 3.00 (B) grade-point average in graduate-level courses. The Department may request a one-semester temporary continuation of support for a student whose grade-point average has fallen slightly below 3.00. There are also Departmental rules and guidelines for eligibility for financial support, which are given below in the section **V**.

Tuition scholarship

A student receives a 100% tuition scholarship for fall or spring semesters if they are "on contract," i.e., they are paid at least 50% of the UD minimum stipend and are matriculated as a full-time student. Students maintain full-time status by being registered for i) 6 credits if they are supported as TAs or Research Assistants (RAs), or ii) 9 credits if they have a fellowship or are on sustaining status (see section **Sustaining status**).

TA training

First-time recipients of Teaching Assistantships in the DPA are required to attend the annual Teaching Assistants Learning Sessions offered by the Center for Teaching and Assessment of Learning. International TAs must also attend the ELI/ITA training program and meet the SPEAK/UDIA score requirements to be eligible for a TA appointment. First year students, irrespective of their source of support, are required to take and pass the 1 credit hour course PHYS 601 Introduction to Teaching Physics and Astronomy, at the earliest opportunity.

Instructorships

Some students may be offered positions as lecturers in summer or winter sessions. In order to lecture, a student must have passed the WCE and OCE, or have shown other convincing evidence of competence. In addition, lecturers will be expected to have shown high teaching ability, using student evaluations and/or classroom visits by DPA faculty members as evidence.

Sustaining status

Once a student has satisfactorily completed all course work required for their degree, including either six credits of Master's Thesis (PHYS 869) or nine credits of Doctoral Dissertation (PHYS 969), and has passed both the WCE and OCE, they must maintain matriculation in the degree program during fall and spring semesters by registering for either Master's Sustaining (UNIV 899) or Ph.D. Sustaining (UNIV 999). All students must be

registered and pay tuition in the semester in which their degree is awarded. Sustaining registration is required for summer or winter session only if the degree is awarded during summer or winter session. A student in sustaining status is considered a full time student.

Students can register for Doctoral Dissertation (PHYS 969) only if they have filed the Doctoral Degree Candidacy Recommendation Form. If this form has not been filed but all other requirements for sustaining status have been completed, Ph. D. students should register for 9 credits of PHYS964 Pre-Candidacy Study. Once the Office of Graduate and Professional Education approves the degree candidacy recommendation form, they will change the PHYS 964 Pre-Candidacy course to PHYS 969, which is the final course required prior to transitioning to sustaining status.

V. Departmental regulations and guidelines for graduate student financial support

Regulations

1. Departmental TA support is not guaranteed to students who have not achieved ELI ITA category of I, II or III before the start of their second semester.
2. TA support during summer sessions is guaranteed only to first year students in good academic standing.¹
3. Consistent with OGPE regulations, students on academic probation are not guaranteed support. A student in their second term on probation is not eligible for any Department support.²
4. Students who have not formed a PhD Dissertation Committee within 1 year after passing the WCE will receive no Department support.
5. Students who have not passed the OCE before their deadline are ineligible for funding of any kind.

¹ To be in good academic standing, a student must have 1) a GPA greater than 3.00, 2) fulfilled ELI requirements in item 1 above, and 3), if applicable, met deadlines for forming their Ph.D. dissertation committee and passing the WCE and OCE.

² Department support includes Teaching Assistantships and support from the supplemental graduate support fund. It does not include Research Assistantships, fellowships, and support from PI overhead return.

Guidelines

1. Regular track students who remain in the program for more than 6 years cannot be supported with Department funds.
2. Fast track students who have been in the PhD program more than 4 years cannot be supported on Departmental funds.
3. Students in the M.S. program will not be supported as TAs after the end of their 5th semester in the graduate program.

NOTE the following as a general implementation principle: During the aforementioned approved periods for Departmental support, faculty requests for TA graduate student salary support will only be approved in such a way that one additional TA support is provided by the Department for each student supported by the faculty as an RA. For faculty with no sponsored research funding, only one student supported as TA is allowed.

VI. Guidelines for winter and summer support

1. First year students in good academic standing and in residence are guaranteed full support for the winter and summer sessions. This support will involve TAs.
2. For students beyond their first year TA support is not guaranteed. Normally students will not be assigned more than two TA sections in winter and summer session combined. The two TA sections can be in the winter session. A student supported as an RA in winter session may also receive a single TA section in winter, if their adviser anticipates a shortfall in summer support. Past teaching effectiveness will be used in prioritization of TA assignments.
3. Students who do not have support for one or more months in the summer are eligible to receive support from the Departmental supplemental graduate support fund. Priority will be given to students who have not been offered TA support or whose advisors do not have funds to support them as RAs. The monthly amount of support is determined by dividing the fund by the total number of unfunded, summer student months but it will not exceed the equivalent monthly TA/RA stipend rate.

VII. Time limits for the completion of degree requirements

Degree time limits

Time limits for the completion of degree requirements begin with the date of matriculation and are specifically expressed in the student's letter of admission:

1. *M.S. degree program*: The University time limit is **ten consecutive semesters (5 years)** to complete the degree requirements. Students completing the requirements for the M.S. degree who are subsequently granted permission to continue toward the doctoral degree are given an additional ten consecutive semesters.
2. *Ph.D. program for students entering with a M.S. degree*: The University time limit is **ten consecutive semesters (5 years)** to complete the degree requirements.
3. *Ph.D. program for students entering without a M.S. degree*: The University time limit is **fourteen consecutive semesters (7 years)** to complete the degree requirements.

Degree time limit extension

If extenuating circumstances exist that are beyond a student's control, a request for an extension of time limit for *an additional year* would have to be made by the student, *in writing*, to the departmental Graduate Review Committee. The request would have to be approved by the departmental Graduate Review Committee and the student's advisor. The department will forward this request to the Office of Graduate and Professional Education, who will in turn determine the student's eligibility for a time extension and will notify the student in writing of its decision to grant an extension of time.