

# GRADUATE PROGRAM HANDBOOK

This document describes the doctoral program in the Physics Department and reflects current information, policies, and procedures for Ph.D. students. It supplements the Graduate Studies Office policies which outline the general university requirements and are available at <http://www.drexel.edu/provost/graduatestudies/>.

## Master of Science Program in Physics

Students who wish to complete only the master's degree are welcomed, and will find that the learning environment will allow them to broaden their professional understanding by exploring current topics and trends of physics in an interdisciplinary setting.

The requirement for the master's degree in physics is 45 graduate credits, with at least 30 credits taken in Mathematical Physics (PHYS 501 & PHYS 502), Dynamics I (PHYS 506), Electromagnetic Theory (PHYS 511 & PHYS 512), Quantum Mechanics (PHYS 516, PHYS 517 & PHYS 518), and Statistical Mechanics (PHYS 521 & PHYS 522). There are no thesis, language, or special examination requirements for the master's degree.

## Doctoral Degree Requirements

The Doctor of Philosophy degree is conferred in recognition of breadth of scholarship and scientific attainment, plus demonstrated ability to investigate scientific problems independently and efficiently. Doctoral students are required to take a minimum of 45 credits of coursework and research work beyond the master's requirement of 45 credits.

Ph.D. candidates must pass a candidacy examination, written and oral; satisfy a one-year residence requirement; and perform original research, write a satisfactory thesis describing that research, and defend this thesis in an oral examination. The usual schedule for physics graduate students consists of two years of course work, qualifying exams, research training

and dissertation research. It is required by the university that a graduate student complete the Ph.D. degree within seven years after enrollment. We expect that most students can complete the Ph.D. in five years.

## Physics Department – Ph.D. Timeline

The information in this section is an outline of the program sequence and should help students identify the steps involved in completing their Ph.D. Students are expected to follow this sequence in a timely manner to make satisfactory progress.

TERM	FIRST YEAR REQUIREMENTS
Fall	<input type="checkbox"/> 501 - Mathematical Physics I <input type="checkbox"/> 506 - Dynamics I <input type="checkbox"/> 750 - Special Topics
Winter	<input type="checkbox"/> 502 - Mathematical Physics II <input type="checkbox"/> 516 - Quantum Mechanics I <input type="checkbox"/> 750 - Special Topics <input type="checkbox"/> Plan of Study <a href="#">Form D-1</a> filed by the fourth week of the second quarter of enrollment as a Ph.D. student. <input type="checkbox"/> Find Research Advisor for Spring quarter research
Spring	<input type="checkbox"/> 521 - Statistical Mechanics I <input type="checkbox"/> 517 - Quantum Mechanics II <input type="checkbox"/> Research oral report by last week of quarter
Summer	<input type="checkbox"/> Research written report by last week of quarter <input type="checkbox"/> Complete Annual Activities Report <input type="checkbox"/> Pass the written Qualifying Exam given in September (before beginning of second year – First attempt)

TERM	SECOND YEAR REQUIREMENTS
Fall	<input type="checkbox"/> 522 - Statistical Mechanics II <input type="checkbox"/> 518 - Quantum Mechanics III <input type="checkbox"/> 750 - Special Topics
Winter	<input type="checkbox"/> Pass the written Qualifying Exam given in January, if necessary (Final attempt) <input type="checkbox"/> 511 - Electromagnetic Theory I <input type="checkbox"/> 750 - Special Topics <input type="checkbox"/> Plan of Study <input type="checkbox"/> File <a href="#">Form D-2</a> indicating research advisor for oral qualifying exam project
Spring	<input type="checkbox"/> 512 - Electromagnetic Theory II <input type="checkbox"/> 997 - Research <input type="checkbox"/> Pass the oral Qualifying Exam <input type="checkbox"/> Completion of 45 credits <input type="checkbox"/> <a href="#">Form D-3</a> : Doctoral Candidacy Committee Appointment & Exam Schedule <input type="checkbox"/> Obtain the Doctoral Candidacy by the end of 2nd Year <input type="checkbox"/> Apply for MS degree <input type="checkbox"/> <a href="#">Forms D-4 and D-4a</a> : Reports on Candidacy Examination
Summer	<input type="checkbox"/> Find Research Supervisor and complete <a href="#">Form D-2</a> <input type="checkbox"/> Thesis Advisory Committee meeting <input type="checkbox"/> Annual meeting & Annual Activities Report <input type="checkbox"/> Begin Thesis Research

TERM	THIRD YEAR REQUIREMENTS
Fall	<input type="checkbox"/> 998 - Dissertation (9 credits every quarter)
Winter	<input type="checkbox"/> 998 - Dissertation
Spring	<input type="checkbox"/> 998 - Dissertation <input type="checkbox"/> <a href="#">Form D-5</a> : Appointment of the Thesis Advisory Committee
Summer	<input type="checkbox"/> 998 - Dissertation <input type="checkbox"/> Thesis Advisory Committee meeting <input type="checkbox"/> Annual meeting & Annual Activities Report

TERM	FOURTH YEAR REQUIREMENTS
Fall	<input type="checkbox"/> 998 - Dissertation
Winter	<input type="checkbox"/> 998 - Dissertation
Spring	<input type="checkbox"/> 998 - Dissertation
Summer	<input type="checkbox"/> 998 - Dissertation <input type="checkbox"/> Thesis Advisory Committee meeting <input type="checkbox"/> Annual meeting & Annual Activities Report

TERM	FIFTH YEAR REQUIREMENTS
Fall	<input type="checkbox"/> 998 - Dissertation <input type="checkbox"/> Review Thesis Manual: All doctoral dissertations, in addition to originality and scholarly content, must conform to University format requirements
Winter	<input type="checkbox"/> 998 - Dissertation
Spring	<input type="checkbox"/> 998 - Dissertation
Summer or Expected Graduation Term	<input type="checkbox"/> 998 - Dissertation <input type="checkbox"/> Graduating students must submit the <a href="#">Completion form</a> by the first day of final exams during the term in which his/her complete his/her studies. <input type="checkbox"/> <a href="#">Form D-6</a> : Appointment of the Final Oral Defense Committee <input type="checkbox"/> Room Reservation for oral defense <input type="checkbox"/> Ph.D. dissertation and oral defense <input type="checkbox"/> <a href="#">Form D-7</a> : Report of the Final Oral Defense Committee <input type="checkbox"/> <a href="#">Thesis Approval</a> : This form must be completed by all students with a thesis requirement and will be included in the bound thesis filed with the library. <input type="checkbox"/> Provide bound copies of your thesis to the Advisor and the Department of Physics.

## Required Coursework

The Physics Department requires that a student complete required courses. The Plan of [Study form \(D-1\)](#) should be filed with the Office of Graduate Studies by the fourth week of the second quarter of enrollment as a Ph.D. student. During the first year of employment as a Teaching Assistant, and as a university requirement, students must also take EDUC 531 and EDUC 775 (Tutorials in College Teaching). Note carefully that students must maintain at least a 3.0 (B) grade point average and that only grades of C and above count for graduate credit.

<b>YEAR</b>	<b>FALL</b>	<b>WINTER</b>	<b>SPRING</b>
First Year	501 - Mathematical Physics I  506 - Dynamics I  750 - Special Topics	502 - Mathematical Physics II  516 - Quantum Mechanics I  750 - Special Topics	521 - Statistical Mechanics I  517 - Quantum Mechanics II
Second Year	522 - Statistical Mechanics II  518 - Quantum Mechanics III  750 - Special Topics	511 - Electromagnetic Theory I  750 - Special Topics	512 - Electromagnetic Theory II  997 - Research

## Special Topics Courses

Special topic courses are an introduction to current topics of experimental and theoretical interest. They are offered in alternate years.

<b>YEAR</b>	<b>FALL</b>	<b>WINTER</b>	<b>SPRING</b>
2007 (odd)	750 - Galactic Dynamics  750 - Biophysics	750 - Cosmology  750 - Computational Biophysics	TBA
2008 (even)	750 - Solid State  750 - Nuclear & Particle Physics	750 - Nonlinear Dynamics  750 - Nanoscience	TBA

## **Registration for Courses Paid by Tuition Remission**

For students supported by assistantships (TA or RA), who receive tuition remission, courses taken outside the Department of Physics are allowed only with permission of the Department. Authorization must be obtained in advance from the Department Head or Director of Graduate Studies. Students will be financially responsible for any unapproved tuition credits.

## **Find a Research Advisor**

A student should find a research advisor by the end of the Winter Quarter of the first year and should begin independent research in that faculty member's field of study under his or her supervision. When a student finds a research advisor, he or she must inform the Director of Graduate Studies.

Students who have begun independent research with a faculty member are expected to attend the department's colloquium and seminars in their fields of specialization on a regular basis.

Students who would like to switch research and decide to investigate other possibilities are encouraged to talk to other professors about different opportunities. It is the student's responsibility to communicate to his/her research advisor about their intention.

## **Advising and Mentoring**

The Physics Department has adopted the following first year advising and mentoring program.

- The Director of Graduate Studies is responsible for advising first year students until they are established with a research advisor, a faculty member who has agreed to supervise a student's research.
- Graduate students volunteer to be a graduate student mentor and are paired with a first year student.
- During orientation, first year students meet with the Director of Graduate Studies and their mentor.
- Mentors are in regular contact with the first year students throughout the year and faculty advisors meet with first year students on an as needed basis.

- Students are encouraged to discuss their courses with their faculty advisor throughout their career.

## Written Qualifying Examinations

The qualifying examinations serve to ascertain that a Ph.D. candidate demonstrates competency across a broad spectrum of core subjects. Furthermore, the preparation process for taking the exams is a learning and integration opportunity that allows the student to develop a more global understanding of physics, in an independent setting (meaning outside the normal course setting that students have experienced up to this point).

The written qualifying examination is given twice a year, during the week before the fall quarter begins and the first week of classes of the winter term. The exam is typically administered on a Friday from 9:00 a.m. to 4:00 p.m.

Students usually take the written qualifying examination just before the start of their second year of graduate study, but may take it earlier. Students who have not passed the exam by the beginning of spring quarter of their second year will be dismissed.

The qualifying examination covers four general areas at the advanced undergraduate level: classical mechanics, electricity and magnetism, quantum mechanics, and statistical physics. Example exams from previous years are posted on the department web page.

## Oral Qualifying Exam

The oral qualifying exam is based on original research performed by the student. A written report of no less than 15 pages should be submitted to the exam committee and the Director of Graduate Studies at least one week prior to the exam. The student will present a talk to the department and committee and be questioned by both. The student will take these exams after successful completion of at least one year of graduate work at Drexel and prior to the end of the second year of doctoral study. The purposes of the oral qualifying exam are to determine the student's ability to begin thesis-level research; to ascertain his or her understanding of the fundamental concepts and ideas pertinent to the field of endeavor; and to detect any deficiencies of background that may need further attention. Students should complete the [Doctoral Candidacy Committee Appointment & Exam Schedule Form \(D3\)](#). This form is to be filed with the Graduate Studies Office at least four (4) weeks prior to the scheduled date of the examination. The committee must consist of at least five members, at least three of whom must be currently tenured or tenure-track Drexel faculty members. At least two of the committee members must be from outside the student's primary specialization area. At least one of the committee members must be from outside the student's department, preferably from outside the university. The student's academic department must submit a Report of Ph.D. Candidacy Requirements ([Form D4](#)

and Form [D4a](#)) to the Office of Graduate Studies to finalize a doctoral student's candidacy status. Only if it is deemed appropriate by the Director of Graduate Studies may the oral qualifying exam be attempted a second time.

The time, date, and location of the talk announcement should be distributed by the student by email and by posting a notice on the Department's Main Office one week before the exam.

## **Doctoral Candidacy**

A graduate student becomes a doctoral candidate when he/she has passed the qualifying exams (both written and oral) and has accumulated at least 45 credits (including all required coursework listed above and with a minimum GPA of 3.0).

All doctoral candidates are entitled to a special tuition discount. Doctoral candidates can register for up to nine (9) credits per quarter and will only be charged for one (1) credit hour.

Once a student passes the candidacy examination, he or she must be continuously enrolled for a minimum of 1 credit for 3 quarters per academic year until all degree requirements are fulfilled, including the filing of an approved dissertation in the library.

## **Find a Thesis Advisor**

A thesis advisor guides and assists a student in working toward a doctoral degree and is expected to evaluate the student's performance throughout the program. A supervising professor should be appointed using the [Form D-2](#) by the end of a doctoral student's second year of study. New Form D-2 should be filed if the student changes advisors.

## **Annual Progress Reports**

Students are required to submit the **Annual Activities Report Form**. To help students maintain satisfactory progress and to encourage advisor-student contact, students are required, every summer quarter, to complete an annual activities report, which includes comments from their research advisor, as well as a proposed time schedule for finishing the degree. The Director of Graduate Studies will review the reports and meet with students and/or their advisors when progress appears slow.

## **Thesis Advisory Committee**

The students should have a discussion with their Thesis Advisor about which faculty should be on their thesis advisory committee ([Form D-5](#)). Then, the students should ask the faculty if they would be willing to serve on their committee. Students should also make room reservations for required meetings. Annual Thesis Advisory Committee meetings are required for all doctoral candidates.

## **Register for Physics 998, Doctoral Dissertation**

Students should register for PHYS 998 in all quarters after passing the Oral Qualifying Examination. Students are limited to a maximum of 9 dissertation credits per quarter.

## **Ph.D. Final Oral Defense**

This examination constitutes an open defense of the dissertation. However, the Final Exam Committee is always free to raise any questions it may wish. The Committee must be approved by the Associate Vice Provost for Graduate Studies via the Final Oral Defense Committee Appointment and Schedule ([Form D-6](#)). This form must be submitted for approval at least one month prior to the defense. The Candidate is reminded that a printed copy of the final dissertation must be distributed to all Committee members and the Director of Graduate Studies at least two weeks before the scheduled exam to allow sufficient time for a thorough review and analysis.

The time, date, and location of the oral defense announcement should be distributed by the student by email and by posting a notice on the Department's Main Office one week before the exam.

The Committee must consist of at least five members, three or more of whom must be currently tenured or tenure-track Drexel faculty members. Two members at minimum must be from outside the student's major area and at least one member preferably from outside the student's department.

Results of the defense are reported to the department and Office of Graduate Studies by the Committee Chair via the [Form D7](#). Signatures of all committee members must appear on the completed [Form D7](#). This form must be returned to the Office of Graduate Studies by the Committee Chair within 48 hours of the exam. The Committee should also formally approve the dissertation using the Thesis Approval Form; the student is

responsible for making sure all signatures are obtained and the original is submitted for binding with the thesis. In the case of a disagreement within the Committee, the Chair should consult with the Associate Vice Provost for Graduate Studies.

## **Dissertation Format**

All doctoral dissertations, in addition to originality and scholarly content, must conform to University format requirements. Students should obtain a copy of the [Thesis Manual](#). The doctoral student and supervising professor are responsible for conforming to the university format requirements.

## **Ph.D. Students Graduation Checklist**

1. File an [application for degree](#) by the [appropriate deadline](#) for the term in which you intend to graduate.
2. Submit your [Form D-5](#) to the Graduate Studies Office at least three months prior to your thesis defense date, if not already filed.
3. Submit your [Form D-6](#) to the Graduate Studies Office with your defense date and committee composition one month prior to your final defense.
4. Review the Thesis Formatting Manual and start formatting your thesis.
5. Take two forms with you to your final defense - the [Report of the Final Oral Defense Form \(D7\)](#) and the [Thesis Approval Form](#). Your committee members will need to sign these forms.
6. After your final defense, have your department send the [Form D-7](#) to the Graduate Studies Office at 3141 Chestnut Street, Randell Hall 240.
7. Fill out the [Completion Form](#) and have it signed by the appropriate people.
8. Submit the original, copies, and a PDF of your dissertation to Hagerty Library along with fees, along with: your original [Thesis Approval Form](#) (signed and approved by all your thesis committee members, advisor, and your department head) to be bound with your thesis; and your [Completion Form](#), to obtain the thesis/dissertation assistant's signature.
9. Submit bound copy to Department's office.

10. Submit your signed [Completion Form](#) to the Graduate Studies Office (3141 Chestnut Street, Randell 240) for final degree clearance.
11. Complete the Survey of Earned Doctorates and return with your [Completion Form](#) to Graduate Studies.
12. Review the University's Graduation Requirements and ensure you are in full compliance.

### **Full-time vs. Part-time Student Status**

The following information about student status is just a guide; the actual requirements of an outside agency may vary. University policy on this matter is posted online at <http://www.drexel.edu/provost/graduatestudies/policies.asp#timestatus>

Based on course enrollment, graduate students are full time when registered for at least 9 credits for any three quarters in an academic year. As noted in the plan of study detailed in this handbook, graduate students in the full time Ph.D. program do not always register for 9 credits in each quarter. Tuition remission for supported students is given during the first two years for the 45 credits necessary to achieve doctoral candidate status (and receive the MS degree). The typical pattern of registration during the Fall, Winter, Spring quarters in the first two years is 9, 9, 6, then 9, 6, 6. During the first Summer (between first and second years) students will register for just one credit. This means that there are four quarters during which students are "less than full time" by the credit-counting rule.

After reaching doctoral candidacy, most Ph.D. students register for 9 credits per quarter of Dissertation Research (for which billing is only for one credit) and so are full-time in every quarter.

It is important that students be aware of their status, whether they are considered full time or part time, for many purposes, including U.S. immigration status, student loan deferral, and outside health insurance. It is the responsibility of the student to be aware of the student status requirements of their visa, loan, insurance, etc. and to comply with those requirements.

International students must be full-time students. In any quarter in which international students are registered for less than 9 credits, they should fill out the "Less than full time form" available from the International Student and Scholars Services office. That form indicates that the student is, for immigration purposes, still considered a full time student because they are engaged in research (e.g., working on Ph.D. dissertation or working as a RA), performing teaching assistantship duties, or other activities. This form is online at <http://www.drexel.edu/iss/FT%20Certification.pdf>

For purposes of student loan deferral, graduate students must be enrolled for at least half-time (4.5 credits).

Students who are carried on family health insurance policies should carefully check on the terms of their coverage, as regards full-time student status. The Graduate Studies Office may provide documentation to support "full time" status in these cases.

## University and Department Policies

The information in this section reviews important University and Department policies regarding Graduate Study.

### Enrollment Requirement

Full-time quarterly enrollment for graduate students is **9 credits**. A student must maintain registration as a full- or part-time student for the quarter the master's degree, or doctoral degree is conferred. The responsibility for being properly registered for courses and maintaining full-time status rests with the student.

### Grades

It is the student's responsibility to check grades in Banner each quarter to make sure they have been correctly reported. The student should see his/her instructor about grade disputes and missing grades. Incomplete (INC) indicates that some portion of the student's work is lacking, for an acceptable reason, at the time the grades are reported. The students should make sure that "INC" grades are cleared when courses are completed. "INC" grades will be changed to "F" after one year and will be reflected in the student's GPA. **A graduate student must maintain a minimum grade point average (GPA) of 3.00.**

### Grade Points

Grade points for each credit hour received in a course will be computed as follows:

A+ = 4.0	B+ = 3.33	C+ = 2.33	D+ = 1.33
A = 4.0	B = 3.0	C = 2.0	D = 1.0
A- = 3.67	B- = 2.67	C- = 1.67	F = 0.0

### **Repeating Courses**

Graduate students may repeat any course. Both the first and second grades will be included in the cumulative GPA. Subsequent grades will not be included, but will appear on the permanent record. The number of credits earned in the course will apply toward degree requirements only once. A grade below C is not accepted for credit toward a graduate degree. Students may only repeat a course in which they received a grade of C-, D+, D, or F.

### **Language Competence Requirements and Examinations**

It is assumed that students from English-speaking countries who are admitted to the Graduate School are competent in the English language. Students from non-English-speaking countries must demonstrate a satisfactory command of English, both for admission and for appointment as Teaching Assistants.

### **Satisfactory Progress**

Admission for graduate study at Drexel allows students to continue graduate study and research in the Department of Physics only as long as they maintain satisfactory performance and progress toward completion of their graduate degree program.

Students whose cumulative or quarterly GPA falls below a 3.0 will be on probation and risk dismissal if they do not raise their GPA above 3.0 within two quarters. Doctoral program students are to be reviewed by the Director of Graduate Studies. In evaluating the student's performance and progress, all of the following will be reviewed:

1. Grade reports: cumulative and quarterly GPA's computed on those courses required in the Physics Graduate Program,

2. Performance during informal course work and seminars,
3. Research capability, progress, and performance.
4. Any other information relevant to graduate program academic requirements.

A determination of satisfactory performance and progress may be made upon review of the factors indicated above. Students who fail to meet any of the requirements may be placed on probation. If a student is placed on "Probation," a definite timetable for remedying the situation is required and can lead directly to termination from the program.

### **Community Responsibilities**

As members of the Physics community, all students are expected to help out occasionally with special events such as our department open houses, conferences, and colloquia.

## **Financial Support**

Continued financial support from an assistantship (TA or RA) requires that a student maintain regular academic status and make adequate progress toward completing their degrees. Students with a Research Assistantship (RA) or Teaching Assistantship (TA) are expected to spend full time on education and assigned duties and may not engage in any other activity for compensation without the specific approval of the Director of Graduate Studies.

### **Research Assistantships**

Research Assistantships support students that are pursuing a graduate degree and devote full attention to their research. They are funded by external sources and the RAs are supervised by the faculty member who has obtained funding for a specific project. The appointments are generally given on a term basis.

### **Teaching Assistantships**

In addition to provide support for graduate students, teaching assistantships help students to enhance their classroom skills. All incoming graduate students are required to

participate in the TA orientation program and to take EDUC 531 and EDUC 775. Foreign students must be cleared by the English Language Center before they can work as TAs. Teaching Assistants work for 20 hours per week teaching classes, grading homework and exams for instructors, and supervising labs. If a student is supported as a TA and starts working towards a non-physics degree, TA support will generally be terminated.

## **Funding Opportunities**

There are a variety of external funding opportunities available to graduate students and they are encouraged to apply (NSF, NASA, Department of Energy, National Academies, etc).

## **Travel Support**

The Office of Graduate Studies offers a limited amount of [travel grants](#) to encourage student participation in academic meetings and conferences. The maximum amount awarded will be \$200 plus registration fees if applicable (up to an additional \$200). Applications are due at least one month before the conference begins.

## **Who's Who**

**Professor Michel Vallières**, Department Head, (215) 895-2709, [vallieres@physics.drexel.edu](mailto:vallieres@physics.drexel.edu), Disque Hall, 8<sup>th</sup> Floor, Room 816. Assigns teaching assistantships.

**Professor Michael Vogeley**, Director of Graduate Studies, (215) 895-2710, [vogeley@drexel.edu](mailto:vogeley@drexel.edu), Disque Hall, 8<sup>th</sup> Floor, Room 811.

**Mrs. Laura D'Angelo**, Research Coordinator, (215) 895-2711, [lauradangelo@drexel.edu](mailto:lauradangelo@drexel.edu), Disque Hall, 8<sup>th</sup> Floor, Room 816. She collaborates with the Director of Graduate Studies. Supports graduate students especially with course information and curriculum requirements. She keeps track of the students' academic issues including transcripts, progress reports, funding information, etc.

**Ms. Janice Murray**, Operation Manager, (215) 895-6863, [murrayje@drexel.edu](mailto:murrayje@drexel.edu), Disque Hall, 8<sup>th</sup> Floor, Room 816. She oversees the financial accounts in the department and handles HR issues. She is involved with the hiring of graduate students as course teaching assistants (TAs), processes the RA/TA stipends, and temporary student appointments.

**Ms. Jacqueline Sampson**, Program Coordinator, (215) 895-2708,  
[jackie@physics.drexel.edu](mailto:jackie@physics.drexel.edu), Disque Hall, 8<sup>th</sup> Floor, Room 816. Scheduling of courses.

**Mr. Tim Jones**, TA and System Administrator, (215) 895-1546,  
[timjones@physics.drexel.edu](mailto:timjones@physics.drexel.edu), Disque Hall, 9<sup>th</sup> Floor, Room 916. Setup of computer accounts.