

**DEPARTMENT OF PHYSICS AND  
ASTRONOMY**

**DARTMOUTH COLLEGE**

**GRADUATE STUDENT HANDBOOK**



**DARTMOUTH**

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## **Section I Practical Matters**

### **1. Welcome and Overview**

The Department of Physics and Astronomy faculty and staff bid you a warm welcome to Dartmouth! We look forward to a rewarding collaboration as you make the transition from a student to a working research physicist or astronomer. Your primary source of information and guidance will be your faculty advisor. However, we hope you will take the opportunity to get to know each of us. (A brief introduction to staff positions is given in the logistics subsection, with faculty research interests described in previous mailings.) In addition, this handbook provides a written source for the most important rules, guidelines, and other helpful information.

As of the current edition, many policies and procedures are revised in view of the graduate student union labor agreement. We have attempted to provide the most up-to-date information; however, please recognize that this is a work in progress. Revisions of this manual, and a more detailed handbook from Guarini will be forthcoming. When in doubt, consult the Physics & Astronomy Graduate Curriculum and Policy committee, Guarini, and Graduate Organized Laborers of Dartmouth-United Electrical Workers Local 261 (GOLD-UE).

You should start your graduate career with an emphasis on course work, filling in your knowledge to the depth and breadth required of a versatile physicist or astronomer. Soon after your arrival, you will meet with faculty members to assess the strength of your undergraduate preparation (see Section II-2 (A) of this handbook). This will help us place you in the appropriate courses and ensure that graduate students with diverse undergraduate backgrounds progress expeditiously through the program. Some students will be advised to supplement weak areas in their background with undergraduate courses. The degree requirements for physics and astronomy students are given in Section II-1.

Another important component of your first couple of years here will be undergraduate laboratory teaching and grading, which gives you experience teaching and communicating physics and astronomy to others. Many of us find that our understanding of physics improves and our questioning of the principles of physics becomes deeper when we consider the best way to teach that material to a beginning student. This teaching experience is important enough that we have made it a degree requirement.

By the start of the spring term of your first year, you should take a close look at the research groups that interest you. It is expected that students will find a research advisor at this time and start preliminary research. Research activity generally flourishes in the summers while most of the undergraduates are away. You will want to take full advantage of this special time.

Students concentrating in physics are required to take six courses from a prescribed graduate physics curriculum. Five of these must be taken in the first year. Furthermore, students must

demonstrate competency by earning a minimum grade of “Pass” in four specific core courses by the end of the second year. This is explained in more detail in Section II-2.

Students concentrating in Astronomy must complete and successfully present a research project under the guidance of an Astronomy faculty by the end of their first summer term.

After the second year of graduate school, the teaching and course load decreases and research will become your primary focus. For students entering with a Bachelors’ degree, before the end of the spring term of the third year in residence you must have presented a thesis proposal, which is an oral and written presentation that covers the proposed thesis project and related topics (see Section II-8). Advanced incoming students must have attempted the thesis proposal by the spring term of their second year in residence. Most PhD students complete their research and write a thesis in their fifth year, though the best-prepared students sometimes finish in less time than that.

Our graduate program is a resident program, and students are expected to be part of the community of scholars in Wilder Lab. In addition to attending classes in person, it is expected that students will be in residence throughout their graduate careers, attending departmental colloquia, group seminars and interacting in person with their peers and research advisor on a regular basis. With their advisor’s approval, students may be absent from campus for research purposes (such as doing field work, attending conferences or summer schools, or visiting collaborators), and can take vacations (see Section 3). If students plan to be off-campus in a term when they are teaching assistants, they must obtain prior approval from the course instructor for their absence. Extended non-research absences from campus, or extended remote working arrangements for personal reasons, require explicit, written (such as an email exchange), prior approval from your advisor.

The calendar on the next page summarizes a typical graduate student's work. There is plenty of flexibility, but you should consult your advisor and the Graduate Curriculum and Policy Committee before planning deviations from this calendar. Note that the academic year at Dartmouth begins with the summer term, which commences about the third week of June. Graduate students occasionally take courses or fulfill teaching obligations then, but the summer is typically devoted to research, and students and faculty look forward to this period as the best opportunity to become deeply involved in research.

## Typical Graduate Studies Calendar for A Student Entering with A Bachelors' Degree\*

### First Year

Summer (pre-arrival)	Fall	Winter	Spring
<p><b>Review:</b> It is strongly suggested that you spend several weeks reviewing your undergraduate physics in preparation for the graduate program.</p> <p><b>Assessment:</b> Entering physics students take a "no-fault" written and oral exam at beginning of Fall term. Provides basis for course recommendations.</p>	<p><b>Courses:</b> 3 courses. Astronomy students take at least 1 research course.</p> <p><b>Research:</b> Ask faculty and other graduate students about their work.</p> <p><b>Colloquia:</b> Attend departmental colloquia.</p> <p><b>Advisor:</b> Two faculty members will be assigned to you.</p>	<p><b>Courses:</b> 3 courses including TA teaching. Astronomy students take at least 1 research course.</p> <p><b>Research:</b> Ask faculty and other graduate students about their work.</p> <p><b>Colloquia:</b> Attend departmental colloquia.</p> <p><b>Astronomy Students:</b> Placement test in early December.</p>	<p><b>Courses:</b> 3 courses including TA teaching. Astronomy students take at least 1 research course.</p> <p><b>Research:</b> You should find a research advisor early in the spring term and choose an area of research.</p> <p><b>Colloquia:</b> Attend departmental colloquia.</p>

**Teaching:** 2 units as a DF, 1 unit as an RA. (See section II-6).

**Courses:** The expectation is that most first-year students take 2 courses when teaching and 3 courses when not teaching, plus the TA course. Physics students are expected to begin coursework to satisfy the Core Competency requirement with completion by the end of the second year.

**TA course:** First-year PhD students take Physics 256, an introduction for teaching assistants (fall and winter).

### Second Year

Summer	Fall	Winter	Spring
<p><b>Research:</b> You should be active in a research group at this time. Course credit for research through Physics 137, 138 or 139.</p> <p><b>Astronomy students:</b> Prepare Research Exam 1 for astronomy faculty.</p>	<p><b>Courses:</b> 1 to 3 courses.</p> <p><b>Research:</b> You should maintain some activity in research throughout the year. Master's students should have a well-defined project at this point.</p> <p><b>Colloquia:</b> Attend departmental colloquia.</p> <p><b>Seminars:</b> Attend the seminar series appropriate to your research area.</p>	<p><b>Courses:</b> 1 to 3 courses.</p> <p><b>Research:</b> Master's candidates should form their thesis or research committee.</p> <p><b>Colloquia:</b> Attend departmental colloquia.</p> <p><b>Seminars:</b> Attend the seminar series appropriate to your research area.</p>	<p><b>Courses:</b> 1 to 3 courses.</p> <p><b>Research:</b> PhD students should form their research committee. Master's candidates should complete and present their thesis or research. (PhD candidates need not complete a master's degree.)</p> <p><b>Colloquia:</b> Attend departmental colloquia and the seminar series appropriate to your research area.</p> <p><b>Progress:</b> The faculty reviews the progress of second-year students at this time.</p>

**Teaching:** 3 units as a DF, 0.5 units as an RA. (See section II-6).

### Third Year

**Teaching:** 2.5 units as a DF, 0.5 units as an RA. (See page 23)

**Courses:** Remaining coursework should be completed this year. You must have completed at least two research courses by the end of summer term. Students needing a course timeline extension must submit the Required Graduate Coursework Extension form. Your thesis proposal must be attempted by the last business day on or before May 15<sup>th</sup> in the spring term.

**Research:** Your primary focus will be on your research. You must present a thesis proposal in the spring term. Astronomy students must complete Research Exam 2 during summer term.

### Fourth Year

**Teaching:** 2.5 units as a DF, 0.5 units as an RA. (See section II-6).

**Research:** Your primary focus will be on your research. Your thesis proposal must be passed before the end of fall term of the fourth year.

### Fifth Year

**Teaching:** 2.5 units as a DF, 0.5 units as an RA. (See section II-6).

**Research:** You should be completing your thesis research. You should have completed and defended your thesis by the end of the spring term.

\*Students entering with a master's degree in physics or astronomy may be considered advanced by one year (see Section I-3 and Section II-2 for details). Abbreviations: RA = Research Assistant, DF = Dartmouth Fellowship

## 2. Logistics

### General Departmental Information

Among your most valuable initial contacts at Dartmouth will be with the Department Administrator and Administrative Assistant. They are located in room 105 of the physics building, Wilder Laboratory. Drop by and introduce yourself when you arrive. Your mailbox will be located just outside of room 102. They will show you your office space and give you an authorization to obtain a key that will let you into most rooms except faculty offices and the main office. The Administrative Assistant can also help you with office supplies such as paper, red pens for grading and etc. There are PCs and Macs available in room 300. Students may use the photocopier in room 106. Please use the copiers for college business only.

You will also find your graduate student colleagues a particularly good source of general information. Feel free to introduce yourself to them; a list of their office locations will be distributed early fall term.

### Academic Advice

First-year students will be assigned an incoming advisor during an Incoming Graduate Student Review scheduled for you prior to the start of fall term classes. Your advisor is your primary source of information on academic matters. It is recommended you meet with them at least once per term thereafter. When you find a research advisor, that person replaces your incoming advisor and becomes your primary advisor.

The Guarini School of Graduate and Advanced Studies is located at 64 College Street, Anonymous Hall, Suite 102. Important Guarini contacts are The Dean of School of Graduate and Advance Studies, the Registrar and Assistant Dean of Guarini School of Graduate and Advanced Studies, and the Assistant Graduate Registrar. The Assistant Graduate Registrar takes care of transcript requests.

### Housing Information

The Dartmouth College Real Estate Office is located at 4 Currier Place. Links to Dartmouth-owned student housing as well as an extensive list of local privately-owned apartments, condos, rooms, and houses for rent can be found at [realestate.dartmouth.edu](http://realestate.dartmouth.edu).

**You should use your home address (or a PO Box) for personal mail.** Certainly, we understand that on occasion you will need a signature for package delivery. However, personal bills, letters, bank statements, packages, etc. should not come to the department.

### Office Space Policy

Desk space in Wilder is scarce. When seeking new desk space, we ask that all graduate students respect the following policy: (1) Graduate students in need of a desk or wishing to change desks will consult with their advisors to identify suitable possibilities; and (2) Advisors will then

request approval of any changes in desk space from the Building Committee. Upon approval by the Committee, the proposed changes can then move forward.

### **Teaching and Computer Resources**

The Instructional Labs Manager and Instructional Labs Technician coordinate the undergraduate laboratories. You will find both to be valuable resources when you are TAing the undergraduate labs. The Instructional Labs Manager's office is Wilder 200A and the Instructional Labs Technician's office is Wilder 214.

Your primary contacts as a TA will be the professor teaching the course and The Instructional Labs Manager. Students are also encouraged to become acquainted with the Manager of Academic Support who manages the lecture demonstration workshop in Wilder 114/108. The Manager of Academic Support is also a point of contact for managing classroom needs and general building needs.

Your contacts for computer resources are the LINUX/UNIX System Specialist, located in Wilder 341, and Manager of Academic Support. The UNIX and Macintosh contact is our LINUX/UNIX System Specialist while our PC contact is the Manager of Academic Support. They can tell you about the computers available, and how to get an account on the various workstations and mainframes. There are several department-owned computers located in room 300. Dartmouth's Research Computing resources are also available. Use of these computers at Dartmouth for teaching and for limited research projects is presently free of charge.

### **Shops and Stockrooms (wood, metal, electronic, chemical, cryogenics):**

The College Apparatus Shop (metal shop), located in 003 Wilder, is run by the Apparatus Shop Manager and their assistant. Students can bring requests to the shop in person.

The Science Division Electronics Shop is located in 1A Wilder. Students will need to get an account number from their advisor before obtaining electronic parts and design assistance.

Other research laboratory supplies are available from the Chemistry Stockroom (17 Burke Laboratory, ext. 6-3520), and the Biomedical Scientific Stockroom (110 Remsen, ext. 650-1583). Electronic components are stocked in the Chemistry Stockroom.

### **Useful Resources**

Dartmouth College Bulletin of Organization, Regulations, and Courses (The ORC): This is the official source on course offerings and degree requirements. ([www.dartmouth.edu/reg](http://www.dartmouth.edu/reg) - click on ORC/CATALOG tab).

Guarini School of Graduate and Advanced Studies: This contains detailed general information for all graduate students at Dartmouth. ([graduate.dartmouth.edu](http://graduate.dartmouth.edu))

Office of Visa and Immigration Services (OVIS): This is a department that will be best suited to answer visa, immigration, or other related questions for international students. ([ovis-intl.dartmouth.edu](https://ovis-intl.dartmouth.edu))

### 3. Stipends, Outside Employment, and Vacations

Stipends are paid monthly based on a fiscal year running July through June. The first stipend of the year is July 1<sup>st</sup>, paid on August 1<sup>st</sup>. Incoming students receive their first stipend based on the program start date. Sources of financial support available through Dartmouth College include the following:

1. Dartmouth Teaching Fellowship (DF) - This fellowship provides a full tuition scholarship and a stipend. The number of terms of teaching required per year is reduced in the later years, as detailed later (Section II).
2. Research Assistantship (RA) - These awards are available through research grants to individual faculty members or groups, from governmental or private agencies. They provide a stipend equal to that of a Dartmouth Fellowship and may or may not provide a tuition scholarship. If they do not, Dartmouth may provide it. The teaching obligation for an RA is reduced as described later (Section II).
3. Gordon F. Hull Fellowship - This Fellowship may be awarded to an advanced graduate student who is deemed by the three most senior members of the Physics and Astronomy faculty to have outstanding qualifications. The tuition scholarship, stipend and teaching obligations are the same as for a Research Assistantship. There is an allotment for professional expenses such as travel, research books, and special materials. The expense amount is specified in the award letter.
4. Tuition Scholarship - Dartmouth may provide these Scholarships to students who receive stipend support, but no tuition from an outside source, or who are otherwise unsupported.

Stipends from the above sources are subject to state and federal taxes to the extent required by law although tuition scholarships are generally not taxed. Awards are normally made on a 12-month basis. It is expected that graduate students move from internal department support (DF) to externally funded research support (either their own or their advisor's funded RA) by their second or at latest third year in the program except under unusual circumstances. Awards can be terminated any time the departmental Graduate Curriculum and Policy Committee determines that a student is not meeting their obligations. As long as a student remains in good standing, financial support will normally be renewed annually for a period of up to five years for the PhD and two for the MS. In exceptional cases when a longer period is required for the PhD, the student, in consultation with their thesis committee, may wish to petition the departmental Graduate Curriculum and Policy Committee for further extension of support if circumstances warrant. The Graduate Curriculum and Policy Committee should receive such petitions no later than the first day of February of the student's fifth year, in order that they are considered for support beyond June 30<sup>th</sup> of the fifth year. Support is thereafter on a term-by-term basis. Four



weeks prior to the end of each term (last day of instruction), you and your advisor must submit a brief update on your thesis progress (to the chair of the Graduate Curriculum and Policy Committee) and this update will serve as your petition for continued DF support in the next term. If an RA supports a student, extension beyond five years is at the discretion of their advisor.

Students entering with a master's degree in physics or astronomy, and who transfer three or more graduate courses may be considered advanced by one year, with respect to both teaching obligations (see Section II) and financial support. Accordingly, if DF financial support were desired beyond the fourth year in residence at Dartmouth, then a petition from the student, in consultation with their thesis committee would be required no later than the first day of winter term classes of that year.

We strongly encourage students to obtain support from additional sources outside Dartmouth. These may include NSF, NASA and DOD Graduate Fellowships, veterans' benefits, support through industrial employee programs (e.g., IBM or CRREL), etc. Graduate study is considered a full-time commitment, and while students are permitted to earn additional income through outside employment, they must ensure that this employment does not interfere with their academic responsibilities. Dartmouth prohibits the use of its property and resources, including laboratories, equipment, and institutional affiliations, for any outside employment. While prior approval from advisors is not required, students are encouraged to inform their advisors about any outside employment to maintain transparency and ensure it does not conflict with their academic progress.

Many of us find that our most productive research occurs during those quiet periods of the undergraduate holidays, and we are less inclined to take vacations during this highly valued time. Nevertheless, graduate students are entitled to various leaves of absence and time off. (Contact GOLD-UE for details.) This policy does not cover leaves from a student's academic program, which are subject to separate policies. (Contact GOLD-UE for details.) Students are encouraged to take necessary breaks to maintain their well-being. However, students must plan their vacations with consideration for teaching and grading responsibilities, which may extend into undergraduate holidays. It is important to consult with the faculty member you are working with before finalizing any vacation plans. Supervisors may, at their discretion, grant additional days off beyond the minimum amounts specified.

## **4. Miscellaneous**

### **Union, Labor Agreement, and Benefits**

Graduate Organized Laborers of Dartmouth-United Electrical Workers Local 261 (GOLD-UE) is the exclusive bargaining representative for all graduate students enrolled in Dartmouth College degree programs who are employed to provide teaching and research services. Details of the contract negotiated between Dartmouth and GOLD-UE regarding union membership, stipend, medical benefits, dependent childcare, employee assistance and more can be found here:

<https://graduate.dartmouth.edu/admissions-financial-aid/collective-bargaining-agreement-updates/economic-articles-collective>

For inquiries, contact [Graduate.Student.Union.Inquiry@dartmouth.edu](mailto:Graduate.Student.Union.Inquiry@dartmouth.edu) or email [goldartmouth@gmail.com](mailto:goldartmouth@gmail.com).

### **Accident Reporting**

By New Hampshire State law all work-related accidents must be reported and in a timely manner. If you are involved in any type of accident, including [but not limited to] a laceration, chemical spill, radiation, etc., you, your supervisor, or both must notify the Manager of Academic Support within 24 hours. It does not matter if you feel you do not need medical attention – report it. Notification to the Manager of Academic Support can be made in person, by telephone, or e-mail. Notification should include how they can contact you. If you are working in a lab, be sure to notify your supervisor/PI as well. You are also requested to report any accident you may witness within Wilder Laboratory or at Shattuck Observatory, including if it involves someone not employed by the College, e.g., outside contractors, etc. There are several report forms that need to be completed in writing by you or your supervisor, and then forwarded to the Manager of Academic Support, and then they will immediately forward the forms to the State. In the event that an accident is not reported appropriately, and the State fines the College, the individual or PI may be liable for the cost of the fine. Failure to report in a timely manner may result in the accident not being covered by insurance.

### **Graduate Student Representation: Graduate Student Council**

The goal of the Graduate Student Council (GSC) is to nurture and enhance the graduate student community across Dartmouth's graduate departments, schools, and programs.

The GSC consists of elected departmental representatives from all Graduate Arts and Sciences programs, including TDI and Thayer, and non-voting representatives from the Tuck School of Business, the Geisel School of Medicine, and the Undergraduate Student Assembly.

[gsc.dartmouth.edu](http://gsc.dartmouth.edu)

### **Grievance Procedure**

(Contact GOLD-UE for details.)

Please note that allegations of scientific misconduct, violations of the academic honor principle, and certain issues of professional and personal conduct (sexual harassment, discrimination, and others described in the Department of Physics and Astronomy graduate handbook under code of conduct – non-academic regulations), must be reported to and handled by the Guarini School of Graduate and Advanced Studies office.

## **Section II Academic Matters**

We begin this section by spelling out the formal degree requirements, much as they appear in the ORC. We then develop the various aspects (courses, teaching, research, etc.) in detail, placing things in rough chronological order and describing how they fit into your overall learning experience. The Graduate Curriculum and Policy Committee will monitor your progress in all areas to ensure that this is commensurate with the timetable set out earlier. If your progress is satisfactory, and your teaching obligations are met, then you will remain in good standing; your stipend (DF or RA) will normally be renewed through June 30<sup>th</sup> of your fifth year, and you will retain the privileges normally accorded to graduate students (use of the library and computer facilities, access to student loans, etc.). We will refer to more specific conditions relating to good standing in the following discussion. Students entering with a master's degree in Physics or Astronomy, and sometimes in other disciplines and who have transferred three or more courses may be considered advanced by one year with respect to our timetable for completion of the degree requirements, such as the research proposal, completion of course requirements (allowing for transfer credit), teaching obligations, and stipend renewal. At most two courses with the grade LP (low pass) are allowed for credit toward either the master's or doctor's degrees. (Section II-3).

### **1. Degree Requirements**

The graduate program of the Department of Physics and Astronomy does not admit students to a terminal MS degree program: all admitted students are admitted to the PhD program. Nevertheless, some students wish to formally obtain the MS degree en route to the PhD. Similarly, students who depart the graduate program without the PhD may wish to obtain the MS degree. For these reasons we list the requirements for the MS degree.

#### **Requirements for the Master's Degree (MS)**

The general requirements for the MS degree are given in the "Graduate Study" section of the ORC. These requirements, together with the specific requirements of the Department of Physics and Astronomy indicated below, normally allow completion of the degree in two years. It is expected that graduate students who have not completed the equivalent of the Dartmouth Physics major program will do so in their first year of graduate study.

Special Requirements:

- 1) Degree credit for eight graduate courses, exclusive of teaching courses. Two of the eight courses may be Graduate Research. At least six of the eight courses should be in Physics and Astronomy.
- 2) Credit for at least one term of Supervised Undergraduate Teaching (Physics 257).
- 3) Completion of a culminating experience chosen from the following options:
  - a) Completion of a satisfactory thesis, which must be defended before the MS Thesis Committee in a public forum.

- b) Significant co-authorship of a publication submitted to a refereed journal or refereed conference proceedings, defended publicly.
- c) For physics students, satisfy the core competency requirement. For astronomy students, obtaining a Pass on the first-year Research Exam.

### **Requirements for the Doctor's Degree (PhD)**

Entering PhD students are expected to enroll in Physics 256 (Instruction in Teaching for Graduate Students) fall and winter term, which is taken in addition to three regular course credits.

A student will be admitted to PhD candidacy upon:

#### Physics Students:

1. Receiving credit for six out of the following nine prescribed core physics courses: Physics 76, 90, 100, 101, 103, 104, 105, 106, 109.
2. Satisfy the core competency requirement. See Section II-2(C).
3. Presenting a thesis proposal and successfully defending it before an appointed PhD thesis committee, for certification.
4. Passing a departmental review of the student's course record and preliminary research progress.
5. Receiving credit for at least two terms of Supervised Undergraduate Teaching (Physics 257) and Physics 256.

The core competency requirement is satisfied by earning a grade of HP or P in the following courses: P90 Intermediate Quantum Mechanics; P101 Classical Mechanics; P104 Statistical Mechanics; and P105 Electromagnetic Theory I.

Students must achieve thesis proposal certification by the end of the fall term of their fourth year, in order to remain in good standing. The department will admit students who successfully complete these requirements to PhD candidacy.

#### Astronomy Students:

1. Receiving credit for Astronomy 115, Astronomy 116, Astronomy 117, Astronomy 118, Astronomy 174, and any one Physics course numbered 61 or above, and any other courses required by the student's advisory committee. Receiving credit for at least six terms of graduate research.
2. Passing a research exam at the end of their first and second years.
3. Presenting a thesis proposal and successfully defending it before an appointed PhD thesis committee, for certification.
4. Passing a departmental review of the student's course record and preliminary research progress.
5. Receiving credit for at least two terms of Supervised Undergraduate Teaching (Physics 257) and Physics 256.

Students must achieve thesis proposal certification by the end of the fall term of their fourth year, in order to remain in good standing. The department will admit students who successfully complete these requirements to PhD candidacy.

The candidate will receive the PhD degree upon:

1. Receiving degree credit for at least twelve graduate courses, exclusive of teaching courses. Physics students: Two of the twelve courses may be Graduate Research, and at least two terms of Graduate Research must be completed no later than the second summer in residence. Astronomy students: Six of the twelve courses may be Graduate Research, and at least six terms of Graduate Research must be completed no later than the second summer in residence.
2. Receiving credit for at least two terms of Supervised Undergraduate Teaching (Physics 257) and Physics 256.
3. Completing a dissertation of substantial significance and publishable quality.
4. Successfully defending the dissertation before the PhD Thesis Committee in a public forum.

It is expected that most students will receive the PhD degree by the end of the fifth year of graduate study.

## **2. Starting the Path to the PhD**

### **A. Incoming Graduate Student Assessments**

All incoming students will meet with designated faculty to discuss their background in various areas of Physics and Astronomy. The outcome of this meeting will be the assignment of first-year advisors and a recommendation about which courses to take.

For physics students, this process consists of a diagnostic assessment exam, to help identify gaps in preparation, and determine the best plan of coursework. This is a take home, open book, no-fault exam consisting of a small number of problems (4-6) drawn from the Dartmouth undergraduate core curriculum. The exam is distributed during orientation week, and students are given three days to complete. Students may consult any books and notes, though the use of the internet or consulting with another person is not permitted. Each student will then meet in person with a three-person faculty committee for discussion of solutions and oral evaluation. For example, students may be asked to explain their solution-method or discuss the interpretation of a problem. The committee will recommend a plan for coursework based on the results of the evaluation. (For example, a student with a weak preparation in statistical mechanics or quantum mechanics may be advised to take an undergraduate course in that subject.) Incoming students are required to take, or otherwise satisfy, at least 5 of the prescribed graduate core courses by the end of the first year. However, if the faculty committee recommends the student take two or more undergraduate courses (which do not carry graduate credit) then this requirement is waived.

For astronomy students, in December of their first year, students take a placement test to determine the student's knowledge of undergraduate astronomy and physics. The results of the test will be used by the student's advisory committee to determine any supplementary courses, which the student will be required to take.

All students will be notified of their appointment with assigned faculty advisors, which will be scheduled for the week before the beginning of fall term. Students will later select their research advisor and thesis advisor. Students should also work with their current advisor to select a secondary advisor. For all changes to an advisor, students will notify the office staff by completing the Graduate Advisor Change form.

### **B. Transfer and Advanced Incoming Students**

Students entering the PhD program with a MS degree in physics or astronomy who transfer at least 3 courses may be considered advanced by one year with regards to the thesis proposal, teaching obligations, and financial support. Students entering with a MS degree in other disciplines will be advanced one year at the discretion of the department.

1. Graduate credits may be recommended by the Graduate Curriculum and Policy Committee for courses passed elsewhere, provided that the courses are comparable in level and content to Dartmouth courses for which we grant graduate credits. No graduate credits may be awarded, however, for courses taken in partial fulfillment of the requirements for an undergraduate degree. Note that the ORC allows at most three transfer credits toward the MS and at most six toward the PhD degree requirements. In order to receive transfer credit for a course, a student must pass either an oral or a written exam administered by the faculty member in charge of the corresponding course at Dartmouth College. An important exception is that if the credit is for one of the four core competency courses, then the examination is made by the Graduate Evaluation Committee. The deadline to request a transfer is the middle of the first winter term. On the recommendation of the faculty member the Graduate Curriculum and Policy Committee will approve the transfer credit by the end of the first winter term. An "Application for Transfer of Graduate Credit" is required to complete the transfer process.
2. You may receive an exemption from required graduate courses if comparable courses have already been passed (whether or not such courses are eligible for credit).
3. The Graduate Curriculum and Policy Committee must approve requests for transfer credit or exemption before the end of the first winter term.

At most a total of three reading courses, Physics 85 and Physics 127, may be counted toward the PhD course requirement. This restriction is almost superfluous except possibly for students who have taken a large number of graduate courses elsewhere. Even in such cases, one can probably fulfill the course requirement by taking Special Topics courses, Physics 122, with essentially no redundancy.

The “Arts and Sciences Graduate Student Academic Standing Policies,” a copy of which is given in the next section, ultimately determine grading policies.

### **C. Required Evaluations**

#### **1. Physics:**

**Assessment Exam:** During Orientation, first-year physics students take an assessment exam, as described above in Section II-2(A).

**Core Competency:** The core competency requirement is satisfied by earning a grade of HP or P in the following courses: P90 Intermediate Quantum Mechanics; P101 Classical Mechanics; P104 Statistical Mechanics; and P105 Electromagnetic Theory I.

Students who do not achieve a P or better in any of the above courses have an alternate opportunity to demonstrate competency, consisting of a self-study reading course and subsequent examination by a faculty committee.

- a. The self-study reading course is held in either the summer or winter term, and is intended to enable intensive, focused study of the course material.
- b. Evaluation is made in the last week of the term or during examination week, by a three-person faculty committee, including at least one faculty member who has recently taught the relevant course. The committee is appointed by the chair and will be the same for all students.
- c. Evaluation is based on a written and orally defended exam consisting of 4-6 problems at the level of recent core undergraduate and graduate course exams. Faculty who have recently taught the relevant courses are responsible for providing exam problems.
- d. Students have three days to work the problems and turn in their completed solutions. Students may use their own notes, textbooks, and course materials, but may not consult the internet or any other person. Students may consult with the faculty committee for clarification on any problems. The faculty committee will evaluate the written solutions and then meet with the individual students. They will be asked to explain the solution-method (e.g., on a whiteboard). Demonstration of competency will be based upon both the written solutions and oral defense, by a majority vote of the faculty committee.
- e. Students have one attempt per core topic. The grade for the reading course (C/NC) is determined by the chair or designated faculty member and is separate from the evaluation made by the faculty committee.
- f. All attempts must be completed by the end of the second summer (first term of the third year), at which time a determination is made whether the student advances or departs the program.

Students must demonstrate competency (through coursework or evaluation by the above-described examination) in all four core courses. Successful students must find an advisor within

two terms of passing the core or by the fall of their third year, whichever is sooner. Students who do not demonstrate competency in all four topics, or students who do not find a research advisor within two terms, must leave the program.

Students who demonstrate competency in all four topics will have satisfied option 3c of the requirements for the MS degree. Students who do not demonstrate competency may still earn a MS degree if the other requirements are satisfied.

Summary of Deadlines for Evaluations and Thesis Proposal for Physics Students

<b>Physics Entering Qualifications</b>	<b>Normal</b>	<b>Advanced by One Year</b>
Core Competency:	Completed no later than end of second summer (third year).	Completed no later than end of first summer (second year).
Thesis Proposal:	Attempted no later than the end of spring term of the third year in residence and must be passed by the end of fall term of the fourth year in residence.	Attempted no later than the end of spring term of the second year in residence and must be passed by the end of fall term of the third year in residence.

## 2. Astronomy:

**Placement Test:** In December of their first year, students will take a placement test to determine the student's knowledge of undergraduate astronomy and physics. The results of the test will be used by the student's advisory committee to determine any supplementary courses, which the student will be required to take.

**Research Exam 1:** At the beginning of their second year, students will present a written report and make a short oral presentation to their advisory committee on a research project they undertook at Dartmouth. The oral presentation will be followed by questions about the project. Upon completion of this exam, a student will be awarded a pass, low pass, or fail. The student's participation in journal club will be considered by the committee when determining the grade. The advisory committee may place additional requirements on a student who receives a low pass. A failure means that the student must leave the program by the end of the fall term.

**Research Exam 2:** At the end of their third year, students will present a written report and make an oral presentation to their advisory committee on their research at Dartmouth. In lieu of a written report, a student may submit a paper they wrote, which has been submitted, or published by a peer reviewed journal. Students who submit a published or accepted paper will automatically pass this exam and will present their research work as an astronomy seminar. The oral presentation will be followed by questions about the research, and its broader context, including the motivations for the research, the history, and the current status of the field. Upon completion of this exam, a student will be awarded a pass, or fail. The student's participation in journal club will be considered by the committee when determining the grade. A failure means



that the student must leave the program by the end of the fall term. Students who fail their research exam may be awarded an MS degree if they satisfy the requirements for an MS degree by the end of the fall term of their third year.

A more detailed description of the astronomy research exams, including a rubric for their grading may be found on the department's website.

Summary of Deadlines for Evaluations and Thesis Proposal for Astronomy Students

<b>Astronomy Entering Qualifications</b>	<b>Normal</b>	<b>Advanced by One Year</b>
Research Exams:	Must be passed at the beginning of second and third years.	N/A
Thesis Proposal:	Attempted no later than the end of spring term of the third year in residence and must be passed by the end of fall term of the fourth year in residence.	Attempted no later than the end of spring term of the second year in residence and must be passed by the end of fall term of the third year in residence.

#### **D. Courses and Credits**

Physics and Astronomy courses offered for graduate credit are those numbered 61 or higher. The Department of Physics and Astronomy allows graduate credit for any course offered by the Departments of Biochemistry, Biological Sciences, Chemistry, Earth Sciences, Engineering Sciences, Computer Sciences or Mathematics, which receives graduate credit from that department.

You should discuss course selections each term with your advisor, but useful general guidelines for your first year are: concentrate on the core graduate courses in order to satisfy the core competency requirement; take the appropriate undergraduate course(s) if the need is indicated by your Incoming Graduate Student Review; and take one or more of the courses relating to the principal areas of research in the department, Introductory Condensed Matter Physics (Physics 73, offered in the fall), Astrophysics (Astronomy 174, offered in the fall) or Introductory Plasma Physics (Physics 68, offered in the fall). *You need to register for the equivalent of three credits. When teaching, one credit will be Physics 257, which is graded HP/P/LP/NC. The grade does not count towards the degree credits needed in 12 graduate courses.*

#### **E. Special Courses**

Here we summarize information on special courses offered by the program that may not be fully described in the online course catalog (ORC).

PHYS 129: Enterprise Experience Internship

Credits: Counts towards three credits for a maximum of one term.

Terms offered: All

Prerequisite: Must have prior approval of Thesis Advisor (primary mentor), Thesis Advisory Committee (if in place at the time), and Graduate Curriculum and Policy Committee.

Grading: HP/P/LP

Description: This course provides practical training experience through a full-time internship at an institution outside of the Dartmouth College campuses (Lebanon and Hanover). The goal of this course is to provide students with real-world, hands-on experience with existing enterprises in a field directly related to their PhD research through internship during graduate school. Such experience will expose students to diverse career opportunities during graduate school, providing students with lead-time to focus and network in a field of interest prior to completion of their PhD. This course is counted as a graduate research course.

For this course, the student will propose and arrange a paid or unpaid internship in an existing enterprise (industry, government, or other) in consultation with and subject to the approval of their Thesis Advisor (primary mentor), Thesis Advisory Committee (if in place at the time), and Graduate Curriculum and Policy Committee prior to enrollment. The internship must be related to their PhD research and help the student advance their PhD project. This process must be completed 30 days in advance of the term of enrollment. Course enrollment is concurrent with the internship and must be for a period of one term. At the end of the internship, the student will make an oral presentation to the Advisor and Advisory Committee (if in place), and open to the broader Physics and Astronomy (P&A) department community, that addresses the nature of the enterprise they were engaged in, the problem they were assigned, and the results and impact of their project. The purpose of the presentation is to share lessons learned from the internship experience with the P&A community. The presentation will be accompanied by a short but complete written report which is submitted to their Dartmouth advisor and the department's curriculum and policy committee. Neither the presentation nor report should contain confidential information of the enterprise. The final, letter grade (HP/P/LP) for the course performance will be assigned in consultation with the Internship Advisor and the department's curriculum and policy committee.

Financial Matters: The internship may be paid or unpaid by the host enterprise or by Dartmouth stipend, depending on arrangement with their Thesis Advisor (as in cases where the internship is a collaboration that will benefit the Advisor's research.) Internship at another academic institution to perform research is discouraged; the goal of this internship program is to expose students to career environments not found within Dartmouth. The Thesis Advisor cannot serve as or appoint the Internship Supervisor (such as in cases where the proposed internship would be hosted by a local company in which the Thesis Advisor has a stake/role). The student's Thesis Advisor will pay Dartmouth-based health insurance benefits for the term.

A letter from the Internship Supervisor at the proposed host enterprise must be sent to the Thesis Advisor detailing the start/end dates of the internship, and the job function and roles of the intern. The completed Internship Proposal form and accompanying letter must be submitted to the department office 30 days in advance of the term of the internship enrollment.

### 3. Guarini School of Graduate and Advanced Studies Academic Standing Policies

[graduate.dartmouth.edu/policies](https://graduate.dartmouth.edu/policies)

#### Full-Time Student

<https://graduate.dartmouth.edu/policy/requirements-meet-full-time-student-status>

For financial aid purposes, a graduate student enrolled in two or more courses or in a graduate research course is considered to be a full-time student. However, for IRS purposes under certain circumstances, a three-course load may be required for full-time status. Therefore, we advise all students to enroll in three *credits* each term. A full-time student in the Guarini School of Graduate and Advanced Studies who is in good academic standing is considered to be making satisfactory progress unless the student's graduate committee or the Dean of the Guarini School of Graduate and Advanced Studies has placed the student in unsatisfactory academic standing or taken action to separate the student from the college.

#### Satisfactory Progress

<https://graduate.dartmouth.edu/policy/satisfactory-progress>

#### Grade Standards

Course work and grades are only one component of graduate education, and the grading system is designed to reflect this fact. The following grades will be used in courses acceptable for credit toward a graduate degree and as one criterion for determining satisfactory progress.

**HP:** High Pass, indicating work of quality which is distinctly superior. Denotes high standing and satisfactory progress.

**P:** Pass, indicating work of good quality, worthy of graduate credit. This would be the most common grade denoting satisfactory progress.

**LP:** Low Pass, indicating work, which is acceptable for graduate credit, but in which the student exhibited one or more serious deficiencies. Only two LP grades are acceptable for degree credit. A student receiving two LP grades will automatically be placed on probation.

**CT:** Credit, indicating satisfactory work in certain courses, such as research courses, in which assignment of a grade of HP, P, or LP is considered inappropriate. The grade CT is the only passing grade in a course in which it is used.

**INC:** Incomplete, indicating work still in progress. A grade must be assigned to replace the INC by the end of the following term, except with special permission from the Dean of Guarini School of Graduate and Advanced Studies. If the work is not completed the grade will automatically be recorded as NC.

**NC:** No Credit, indicating work, which is not acceptable for graduate credit and automatically places the student on probation.

A graduate student who has received more than one LP grade or has received one NC grade will automatically be placed on probation for one term. (Individual programs may set a standard for course work that is more rigorous than this minimum standard.) The department graduate committee must review the student's progress at the end of the probationary term. The

committee will then inform the Dean of Guarini School of Graduate and Advanced Studies, in writing, if the student has produced course work and/or research at a satisfactory level.

If such is the case, the student will be removed from probationary status. If, however, the student has not met the departmental standards for satisfactory progress, the student will remain on probation until satisfactory progress is achieved according to the written requirements of the student's graduate committee. A graduate student may also be placed in '*unsatisfactory standing*' if the student receives more than two LP's or more than one NC, and may be suspended or permanently dismissed from the program by the department faculty or the Dean of the Guarini School of Graduate and Advanced Studies. **A student in 'unsatisfactory standing' is not eligible for federal loans or Dartmouth scholarships or fellowships.**

In addition to the grade and probation standards set above, the student is also expected to meet quantitative standards by successfully completing coursework in a timely manner. Since there are *full-time* graduate students (those enrolled for *two or more* courses per term) and *half-time* students (those enrolled for only *one course* per term), the quantitative definition is based upon how many courses the student registers for and completes satisfactorily. Full-time graduate students must complete **eight of each consecutive 12 courses** for which they register; Doctoral students are further expected to meet all program requirements for graduation within a *maximum* of seven years and master's program students are required to complete all requirements within a *maximum* of six years.

Academic progress (both qualitative and quantitative) is reviewed at the end of the academic year (completion of the spring term) for both full and half-time students and is reported to the Financial Aid Office. Students who fail to meet the requirements for "satisfactory progress," **will not receive federal loans or Dartmouth scholarships or fellowships.**

Students who have not met satisfactory progress **may** be able to regain this status for *federal financial aid purposes* by completing missing coursework in the next term. As an example, consider a full-time student, enrolled for 12 courses in four terms, who had completed only seven courses prior to spring term. During spring term, the student requested an incomplete grade for three courses. During the next term of enrollment (summer), the student completed the coursework, which changed the INC grades to P, thereby satisfying the eight-course requirement. Although ineligible for aid during the summer term, the student would regain eligibility for the remainder of the academic year.

Since there are various scenarios as to how a student might regain academic progress for financial aid purposes, each student who is interested should make an appointment with the Graduate Financial Aid Officer who will provide advice according to the individual student's record.

Students who have special circumstances which may have affected their ability to maintain satisfactory progress and who wish to appeal their non-eligible status may do so by providing written details and documentation to the Graduate Financial Aid Officer, HB 6024.

Applicants who are interested in finding out if their situation can be re-assessed should make an appointment to see the Graduate Financial Aid Officer by calling 646-2451. (Note: this appeal is for financial aid purposes *only*. Academic status questions should be addressed to the student's department or the Dean of Guarini School of Graduate and Advanced Studies.)

#### **Other Standards Pertaining to Satisfactory Progress**

<https://graduate.dartmouth.edu/policy/other-standards-pertaining-satisfactory-progress>

#### **Transferring Programs**

<https://graduate.dartmouth.edu/policy/transferring-programs>

#### **Withdrawal and Suspension**

<https://graduate.dartmouth.edu/policy/withdrawal-and-suspension>

#### **Dismissal**

<https://graduate.dartmouth.edu/policy/dismissal>

### **4. The Academic Honor Principle**

<https://policies.dartmouth.edu/policy/academic-honor-principle>

### **5. Colloquia, Seminars, and Astronomy Journal Club**

The departmental colloquium is normally held each Friday afternoon during fall, winter, and spring terms. Here you will have the opportunity to listen and respond to well-known physicists and astronomers from other institutions, as they present their research work. The talks are aimed at the non-expert graduate student level. Exposure to the wide range of topics presented is an essential part of your graduate education, and **all graduate students are expected to attend every week**. Although no formal course credit is given, attending the colloquia is just as important as attending your courses. During fall term, the Administrative Assistant is responsible for setting up refreshments before each colloquium and cleaning up afterward. Winter and spring term, this responsibility shifts to the first-year graduate students. The Administrative Assistant will provide students with a schedule of duties. The department provides and pays for the refreshments.

In addition to the departmental colloquia, there are research seminars in each of the four major areas of research at Dartmouth: Astronomy, Cosmology, Quantum Nanophysics, and Plasma Physics, which include Space Physics and Fluid/MHD Theory. These talks are at a more technical level than the colloquia. Graduate students, faculty, and outside visitors present them. You are not expected to attend all of these, although some may be helpful in selecting a research area. Once you have begun research, of course you are expected to attend the appropriate seminar series. You are encouraged to also attend any other seminars of interest in this department and in other departments. A bulletin board near the physics office has a posting of announcements for many of the scientific seminars on campus.

All astronomy graduate students are expected to attend every week the Astronomy Journal Club (AJC). AJC is intended to bring the Dartmouth astronomy community together to engage with the latest literature (or soon-to-be latest literature with our own research). Each grad student is expected to lead a journal club meeting each term. When leading the journal club, a student may either present an update on their research, or give a presentation/lead a discussion of a recent research paper in astronomy or in diversity, equity, and inclusion. To be mindful of everyone's time, a decision on the type of presentation and paper to be discussed must be posted in Canvas at least 5 days before AJC by the discussion leader. To be mindful of the discussion leader's efforts, it is imperative participants read the assigned paper to the best of their ability prior to AJC. During AJC, everyone is expected to adhere to the rules of engagement, which are posted on the AJC Canvas page. In brief, constructive criticism is key. Anyone can speak openly, without interruption or personal judgment. Be patient with yourself and others. Listen respectfully.

## **6. Teaching**

### **Degree Requirement**

As indicated in the ORC, an essential element of graduate education at Dartmouth is the experience gained in teaching other students, especially for the many graduate students who are pursuing academic careers. Therefore, at least one term of undergraduate teaching is required of all graduate students. Each student's program is arranged, according to his/her individual needs and interests, in consultation with the faculty advisor and the department. The requirement may be satisfied with one term of Physics 257 (Supervised Undergraduate Teaching) for the MS degree, or two terms for the PhD Physics 256 (Instruction in Teaching for Graduate Students) is required for the PhD Credit for the completion of both terms of Physics 256 is awarded upon completion of the second term.

### **Teaching Obligations**

The academic year at Dartmouth starts with the summer term (in June). Advanced incoming students with three course transfers may be considered advanced by one year, with respect to both teaching obligations and financial support. Students with a teaching or grading assignment in any given term must register for Physics 257, even if the course requirement has been met. This course is graded HP/P/LP/NC. As with other graded classes, if you receive a grade of NC you will be put on academic probation.

The teaching allocation is 100 hours per term for a grader, and 200 hours per term for a teaching assistant. If a student is consistently exceeding the allocated teaching time (10 hours per week for a grader, and 20 hours per week for TA) they should immediately inform their course instructor and their mentoring committee. Adjustments will have to be made to their TA duties the rest of the term in order to ensure they do not exceed 100 or 200 hours in the term. A one-term laboratory or recitation teaching assignment will normally rate one unit, a grading assignment for a small class one-half unit.

Teaching duties will be made in accordance with the department's instructional needs. During the spring term, students will be asked about teaching/grading preferences for the coming year. This is your opportunity to request specific courses. It cannot be guaranteed that all wishes will be met, but an effort will be made. When a student is assigned to a course, it is that student's responsibility to seek out the professor in charge and to find out from him or her what the specific duties are. General questions regarding teaching obligations should be addressed to the Graduate Advisor of the department (or someone designated by the Chair). Assignments are made on a term-by-term basis, rather than the full year. This process allows us to better know needs based upon actual course enrollments. Concerns on the part of the professor or TA should be discussed with each other as soon as a problem arises. If a reasonable resolution is not achieved, the Graduate Advisor is available to mediate.

Dartmouth Teaching Fellows who receive a regular stipend plus a tuition scholarship will normally teach two units in their first year, three in their second year, and two and a half each year thereafter.

Research Assistants, and other students who receive only a Tuition Scholarship from Dartmouth funds, with either no stipend or a stipend from other sources, will normally teach one unit in their first year, and one half each year thereafter. Graduate Students whose full support (stipend plus tuition) comes from outside sources (e.g., NSF Fellowship, employment, private funds) will have no teaching obligation once the degree requirement has been met (as indicated above).

Students on a combination of DF and RA (e.g., 50% RA and 50% DF), will have their teaching obligation adjusted accordingly.

## **7. Research Advisors and Research Committee**

### **Research Advisor**

You should find a research advisor (at least provisionally) by the spring term of your first year so you can make plans to be engaged in research during the summer term. This means that you must think about the choice of a research area well before then. Most students are uncertain about this choice when they arrive in the fall. However, you will develop a feeling for the research areas by attending colloquia and seminars, attending student presentations such as research proposals and theses defenses, talking with graduate students and faculty about their research, taking one or more of the introductory "specialty" courses such as Astrophysics (Astronomy 174), Introductory Plasma Physics (Physics 68), and Introductory Condensed Matter Physics (Physics 73). As you develop a preference for a research area, you should talk with individual faculty members in that area before reaching a final decision and asking someone to serve as your research advisor. If you reach a decision early, you are certainly welcome to acquire a research advisor and even to begin research prior to the spring term, if you so desire. For all changes to an advisor, students will notify the office staff by completing the Graduate Advisor Change form. Students entering with master's degrees are particularly encouraged to accelerate this process. Student's whose research advisor does not have a primary appointment

in the Department of Physics and Astronomy will not be eligible for departmental Dartmouth Fellowship support and so must be funded as an RA, or some equivalent funding from the research advisor's primary department. Note that your PhD advisor must have an appointment in the Department of Physics and Astronomy.

### **Student Mentoring Committee**

At all times during their time at Dartmouth, graduate students will be advised by a mentoring committee, which will consist of a minimum of two faculty members. The mentoring committee typically consists of the student's research advisor and one other faculty member chosen by the student. The other faculty member could be a member of the student's research exam or thesis proposal committees. The mentoring committee shall provide guidance and advice to the student, and assist the student as needed. Whenever the composition of their mentoring committee changes, the student must inform the departmental administrator and the new members of their committee.

Initially, the mentoring committee for students will consist of the two faculty members who met with the student during their incoming orientation. Once a student starts a research project at Dartmouth and selected a research advisor, the student should make the necessary adjustments to their mentoring committee.

### **Second-Year Review**

In early spring of your second year, the departmental faculty will review your progress in all areas, including preliminary research progress. If your progress appears commensurate with the PhD degree requirements, you will be directed to form a PhD research committee. If your progress is insufficient, you may be directed to work toward the completion of a master's degree by the end of your second summer.

### **MS Research Committee**

Students who fulfill the MS culminating experience with significant co-authorship of a publication submitted to a refereed journal or refereed conference proceedings, must form a research committee. The role of the committee is to assess your work, oversee the public defense of your research, and to make recommendations to the Graduate Curriculum and Policy Committee regarding the fulfillment of requirements and awarding of the MS degree. The committee consists of three full-time faculty members. An external member is not required.

### **PhD Research Committee**

Your PhD Research Committee consists of two full-time faculty members in addition to your department advisor, at least one of whom must belong to this department. You should select these two additional members in consultation with your advisor, who then recommends them to the Dean of Guarini School of Graduate and Advanced Studies, from whom the official appointment must come. Your research proposal (next subsection) will be presented to this committee. The role of your committee is to monitor your research progress and to provide



advice directly to you. Its more formal obligations are to make recommendations to the Graduate Curriculum and Policy Committee regarding the acceptance of your research proposal, your advancement to PhD candidacy, and eventually on the acceptance of your PhD thesis itself. Students are required to meet with their committee at least once per year between the time of their thesis proposal and their defense. The yearly progress report meeting can take whatever form the advisor deems appropriate (short presentation, informal discussion), but requires that the student, the advisor, and the in-house members of the committee all be in attendance. It is the responsibility of the student to arrange each meeting and deliver a completed Annual Progress Report Meeting form within one week of the meeting. Annual Progress Report Meeting forms are available on the department's website or from the department office. This review must be held by the last class day of the winter term. A student may, at the discretion of the Graduate Curriculum and Policy Committee, be put on probation for not scheduling these reviews in a timely fashion.

### **MS Thesis Committee**

Some students write a terminal MS thesis at Dartmouth, and some write a master's thesis en route to the PhD, although it is more typical to skip this step and proceed directly to PhD candidacy. Prior to the presentation of your MS thesis, you must have a thesis committee consisting of three faculty members including two from this department (one of whom is your research advisor), and one member from outside. Your research advisor must recommend this committee to the Dean of Guarini School of Graduate and Advanced Studies, who makes the official appointment. The appointment form is available on the department's website or in the department office.

### **PhD Thesis Committee**

Prior to the presentation and public defense of your PhD thesis, you must augment your research committee by the addition of one full-time faculty member, thus forming your thesis committee. The PhD examination committee consists of a minimum of three full-time Dartmouth Faculty members of which a minimum of two must be from the student's graduate program (including the dissertation advisor) as well as an external member with a faculty-equivalent research appointment outside of Dartmouth. The external member may participate in meetings in person or via videoconference. The responsibility of this committee is to judge your written thesis and your oral defense (see part 8 of this section). Your research advisor must recommend this committee to the Dean of Guarini School of Graduate and Advanced Studies, who makes the official appointment. The appointment form is available on the department's website or in the department office.

## **8. Research Proposal and Student Seminars**

### **Research Proposal Presentation**

The student must, with the help of his/her advisor, formulate a research proposal plan and assemble an examination committee. The committee, which should eventually comprise the PhD Thesis Committee, must consist of three faculty members including the research advisor. The external PhD examiner need not be present for the research proposal.

Prior to the presentation, the student must complete and submit a PhD Thesis Proposal Application (available on the department's website or in the department office). Submission of this form officially notifies the Department of Physics and Astronomy of the student's intent to attempt the PhD Thesis Research Proposal. This form is to be completed and submitted to the Physics and Astronomy Department office no later than the last business day on or before April 1<sup>st</sup> in the spring quarter of the student's third year (second year for advanced incoming students). The application must include a one-page description or abstract of the intended research. The student must then deliver the thesis proposal paper to his/her committee at least five business days prior to the thesis presentation date. The thesis proposal paper is typically 10-15 pages in length, double-spaced, and must include a cover sheet. The faculty will also be notified of the thesis presentation at least five business days prior to the thesis presentation date.

The examination must consist of a seminar-style technical presentation (~45 minutes in length) that is open to all faculty and research associates, as well as a list of graduate students invited by the advisor. Following open questions, the audience apart from the committee will be excused and the examination will continue. The thesis committee will examine the student to determine his/her preparation and planning for research, knowledge of the field, as well as general physics or astronomy knowledge. The committee can recommend pass, fail, or provisional pass with recommendations.

If the student passes, he/she must then submit a copy of the thesis proposal with the committee's signed cover sheet **to the department office within two weeks of the thesis presentation.**

If the student provisionally passes with recommendations, and the committee determines the proposal requires some revisions, then the thesis advisor must notify the student in writing of these deficiencies and the necessary revisions. This letter must be sent to the student within one week of the thesis presentation and must include a firm deadline for completion of these revisions. A copy of the letter must be sent to the Graduate Curriculum and Policy Committee and the department office.

If the student fails, then the student may make up to one further attempt at the thesis proposal.

The PhD Thesis Proposal must be attempted by April 30<sup>th</sup> of the spring term of the third year in residence (second year for advanced incoming students) and must be passed by the end of the fall of the fourth year in residence (third year for advanced incoming students). Any request to delay the thesis proposal must be made in writing to the Graduate Curriculum and Policy Committee no later than the last business day on or before April 1<sup>st</sup> of the third year in residence (second year for advanced incoming students).

If any deadlines are missed, the student must petition the Graduate Curriculum and Policy Committee in order to remain in good standing.

If you have any questions, please speak with your advisor or the Graduate Curriculum and Policy Committee chair.

### **PhD Candidacy**

Receipt of your signed proposal notifies the Graduate Curriculum and Policy Committee that your Thesis Proposal has been successfully completed. If by this time you have also passed the PhD core competency requirement (physics)/Research Exams (astronomy), and your graduate course work has advanced satisfactorily, then you will be eligible for PhD candidacy. In this event, the Graduate Curriculum and Policy Committee will make a formal recommendation to this effect, which will be voted upon by the full department faculty.

### **Student Seminars**

Once you have been admitted to PhD candidacy, you have passed all major hurdles except for the completion of your research and the preparation and presentation of a thesis. During the ensuing period of research, most students find it useful to present seminars on their research. Although such presentations are not compulsory, there are several benefits. The main benefit to you is the feedback you get from your student and faculty colleagues, which accelerates your progress and makes the research experience more meaningful. Other benefits include the experience of presenting difficult material in public and helping to introduce beginning students to the research life of the department.

In addition to public seminars, it may prove useful to give an occasional oral progress report to your research committee. Your committee may request such a report at any time. You are expected to meet with your committee in some format at least once per year between proposal and defense (page 29).

## **9. The Thesis**

You should try to develop independence as a researcher during the course of your thesis research. This goal is not inconsistent with continually seeking appropriate forms of advice from your research committee and other colleagues in the department. The advice of your committee can be especially important in helping you draw conclusions from your research and in planning the writing of a thesis. The thesis should be more than a description of what you did and what results you got. It is a scholarly work, and as such it should present your contribution in the context of the developing knowledge of your field. You should discuss thoroughly the significance of your results, which is frequently deeper than it appears at first sight, and usually not fully appreciated until after considerable discussion with others, especially with your thesis committee.

### **Preparation and Presentation (These remarks apply to both master's and doctoral theses)**

**As soon as you have confirmed a defense time and date with all of your committee members, contact the Administrative Assistant about your preferred room. Sooner is better than later.** Your first choice of room may not be available, so the earlier you are in contact about reserving, the better chance you have of getting your first choice.

Instructions are available from the Guarini School of Graduate and Advanced Studies office for the preparation of the thesis manuscript, as well as online at <https://graduate.dartmouth.edu/student-support/academic-support/writing-support> - See Thesis Guidelines.

Be sure to review these guidelines carefully before finalizing your document. The Department does not pay for thesis preparation, but copies for distribution to thesis committee members can be made on the departmental copier at no charge. Copies should be distributed to your thesis committee **at least one week prior to your public presentation**. The Administrative Assistant circulates an announcement of your defense at least one week prior to the presentation, so be sure to contact them at least 10 business days prior to your presentation with your title and abstract. The public presentation should last about 45- 50 minutes and should be appropriate for a general scientific audience. Immediately following this presentation, you will meet privately with your thesis committee for questioning. Invariably, even if you successfully defend your thesis, the committee will make suggestions for improving the manuscript. After you attend to these corrections and suggestions, the revised thesis must be approved by the committee and the cover sheet signed. A copy of your signed cover sheet is required to complete the certification.

*Please bring the cover sheet to the Department Office two full business days prior to your planned thesis submission date. Finally, you are responsible for submitting the thesis to the Graduate Office.* Online submission instructions are located here:

<https://graduate.dartmouth.edu/academics/graduate-school-forms/thesis-and-dissertation-forms>

Well, there you have it. The thesis presentation is the culmination of a challenging, intense, and rewarding learning experience. We wish you the best of luck as you embark upon this journey.