Department of Physics
University of Massachusetts, Amherst

Graduate Program Handbook
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I. Introduction

The Mission of the Graduate Program in the Department of Physics at UMass Amherst is to prepare the next generation of physicists and scientific leaders for careers academia, industry, and the public sector. We seek to prepare our students to be critical thinkers, researchers, educators, communicators, and scientific visionaries. We do this through a rigorous and varied educational and research program that includes coursework in fundamental and specialized topics, experimental and theoretical research opportunities, training in experimental and analytical techniques, and a variety of professional development opportunities.

In accomplishing our mission, we value excellence in research and teaching, and a climate that welcomes and supports students from diverse cultural, ethnic, religious, and economic backgrounds, sexual orientations, and gender identities. As an integral part of the larger community at UMass, we also embrace our responsibility for outreach, particularly to those who are historically under-represented in Physics.

Graduate Program Organization and Contacts

The Graduate Program Director (GPD) (Lori Goldner, lgoldner@physics.umass.edu, (413) 545-0594) is the faculty member who represents the Graduate School within the Physics Department. They have primary responsibility for oversight of the department’s graduate program. They work with the Department Head, Graduate Curriculum Committee, Admissions Committee, Graduate Advisors, and Graduate Program Manager to advise and advocate for students, certify degree requirements, promote and generally administer graduate school and departmental policies.

The Graduate Program Manager (GPM) (Katie Bryant, kjbryant@physics.umass.edu, (413) 545-2548) manages the graduate program and keeps track of student progress. They manage paperwork associated with milestones, teaching and research associate appointments, travel, and assist students with most other non-academic needs. They are often the first point of contact for students seeking help navigating the UMass system.

Graduate Curriculum Committee (GCC): (Lorenzo Sorbo, Chair, sorbo@physics.umass.edu) Consists of the graduate core course instructors plus the Graduate Program Director. The GCC has primary oversight for graduate-level curriculum; they also write and grade qualifying examinations. They administer Q exams and help develop departmental policies around advancement to candidacy.

Graduate Admissions Committee: (Boris Svistunov, Chair, svistunov@physics.umass.edu). Receives, evaluates, and makes decisions regarding applicants to the Graduate Program.

Graduate TA Assignments: Stephane Willocq, willocq@umass.edu
II. Ph.D. Program Requirements

The requirements for the Ph.D. program in Physics are formulated by the Graduate Curriculum Committee and approved by a vote of the entire faculty. Portions of the program, and particularly the procedure to qualify for candidacy, were overhauled in 2017. Small changes are still being made at the time of writing: this document will be updated as these changes are implemented.

II.1. Statute of Limitations. Students entering with a bachelor's degree in physics should complete all of the requirements for the Doctor of Philosophy degree within six years, although under exceptional circumstances this statute of limitations can be and has been extended.

The graduate program manager runs a query in Spire every semester looking for students who need a Statue of Limitations extension. If needed, a request for an extension is sent to the Graduate Program Director (GPD) for approval via spire. The GPD will request input from the student’s Research Advisor to confirm satisfactory progress. Upon confirmation, the GPD will sign the request, which then goes to the graduate school for final approval. Students should not need to initiate these requests but are always welcome and even encouraged to check to the Graduate Program Manager to be sure their statute of limitations extension has been initiated. Final decision times vary but should never be more than 2 months.

II.2. Core Courses. Students are required to pass the graduate introductory program of studies consisting of 6 core courses. A grade of B- or above is considered passing for purposes of the graduate school; however note that a B- does not automatically qualify a student in that subject (see qualification procedure, below). The core courses, and semesters in which they are offered, include the following:

- P601: Classical Mechanics. Fall semester.
- P602: Statistical Mechanics. Fall semester.
- P605: Methods of Mathematical Physics. Fall semester.
- P606: Classical Electrodynamics. Spring semester.
- P614: Quantum Mechanics I. Spring semester.
- P615: Quantum Mechanics II. Fall semester.

Students should organize their course schedule each year in consultation with their academic advisor. A typical course sequence is as follows:

- Second semester: P606 Classical Electrodynamics, P614 Quantum Mechanics I.
- Third semester: P602 Statistical Mechanics, P615 Quantum Mechanics II.
- Fourth semester and beyond: completion of the three research-area courses

More advanced students, or those with Fellowships permitting more time to devote to classwork, may opt to take three courses some semesters. Students should always discuss course choices with their academic advisors.
II.2.a. Waiving Core Courses. Core courses, including the final exam (see Admission to Candidacy below), may be waived if a student has a record of similar coursework at the appropriate level from another university. Waiver is not automatic, and students requesting a waiver must petition the Graduate Program Director at least one week before the mid-semester add/drop deadline, and preferably much earlier. The steps in requesting a waiver are as follows:

- Student meets with their academic advisor to discuss the pros and cons of waiving.
- Student fills out the course waiver form, providing as much information as possible about the prior course. As a minimum, this should include the name of the text used (if a text was used), chapters covered, and/or a course syllabus from the instructor.
- The completed form and course information should be returned to the Graduate Program Director.
- The Director will forward the form to the instructor currently or recently teaching the equivalent course at UMass, and to the chair of the Graduate Curriculum Committee for their input. Based on that input, the Graduate Program Director will make a decision on the waiver.
- The student will be alerted to the decision regarding the waiver in an email from the Graduate Program Director.

II.3. Admission to Candidacy (Qualification Procedure) There are two components to the Doctoral Qualifying Procedure: a component based on graduate-level physics coursework and an oral component covering a research area chosen by the student. These are discussed in detail below.

It is worth noting that formal admission to Ph.D. candidacy is the result of a holistic review by, and vote of, the entire Graduate Physics Faculty. In this review, performance and accomplishments in coursework and exams, as well as research activity, are considered. The entire Graduate Faculty vote on admission to candidacy of each student after all the core courses have been completed for the first time. Students that successfully pass either their courses or the corresponding qualifying exams are generally approved for candidacy in a pro forma vote. For students struggling to meet the written/coursework requirements described in this handbook, the faculty may vote against advancement, but in that case the student will be provided with advice on how to proceed for a second attempt. Generally this involves consultation with the Graduate Program Director, academic or research advisor, and/or the Graduate Curriculum Committee Chair, to formulate a plan to fill any real or perceived deficits in the student’s understanding. The rules below provide a framework for that plan.

II.3.a. Written/Coursework component. The purpose of this component is to assure that all students admitted to candidacy in the Department have a certain core competency necessary for success in a physics career.

To qualify for candidacy, students must demonstrate competency in 4 of the following 5 courses: Classical Mechanics (601), Electrodynamics (606), Quantum I (614), Quantum II (615) and Statistical Physics (602). Competence in any particular course shall be demonstrated using either of the following methods (both are not required):

1. Passing the course with a B or better.
2. Passing the qualifying exam for that course with 55% or better.
Four out of five courses must meet the standard above. The fifth course is then considered adequate for qualification if the grade is B- or better or the qualifying exam is scored at 45% or better.

Qualifying exams, when offered, take place shortly before the start of the corresponding core course. Because they are optional, Students must request a qualifying exam by [date TBD].

Qualifying exams are written by the members of the Graduate Curriculum Committee. Students may request a qualifying exam without taking the corresponding course, although this request must be approved by the Graduate Program Director and is not generally recommended. A passing grade on the qualifier (55% or better) will generate an automatic waiver from the Graduate Program Director for the corresponding core course requirement. Qualifying exams are graded double-blind, meaning that faculty do not know whose paper they are grading, and students do not know by whom their exams were graded. All problems have at least two graders for quality control.

While the following is subject to change, qualifying exams are currently four hours long and comprised of three problems. They are closed book with no notes permitted. There is a 15 minute period before the exam when students may look over the problems but not write. Each of the problems has equal weight, but the weight of questions within each problem is not fixed and is determined in a case-by-case basis.

A note about course grades: Course grading rubrics are determined by the instructors with advice and guidance from the Graduate Curriculum Committee. While this is subject to change, current grading policy recommends that in-class midterm(s) and final exam grades account for at least 60% of the course grade. Some instructors give more than one midterm and count the exams for more than 60%. Homework generally counts for the remainder of the grade.

Policies around grading are a topic of frequent consideration for the Graduate Curriculum Committee and may change. With that in mind, the following course grading rubric is currently in effect:

- A: 92-100
- A-: 84-91
- B+: 76-83
- B: 68-75
- B-: at the discretion of the instructor, the minimum for a B- falls between 55 and 60.

The “Q” exam in exceptional ways: The department recognizes that no system is perfect. Students learn in different ways and are more or less skilled at taking exams. We recognize that the timing and content of exams is arbitrary, and unlike anything else experienced in a Physics career. We also recognize that the coupling of exams to course grade may be a barrier difficult for some students to overcome. We therefore leave open a second route to fulfilling the coursework requirement in cases where there is evidence for research excellence despite difficulty demonstrating competence through course or qualifying exam grades.

The goal of the Q exam is to help a student demonstrate or develop competence in areas where the course or exam grades were weak. In this case, the Graduate Curriculum Committee (GCC) will pose a question or questions to aid in focusing the student on their perceived areas of weakness. The student will prepare solutions to these problem and then be questioned on them, and related topics, at the Q exam. More details are given below.
It is expected that this is a rarely-used route to qualification that is only appropriate under exceptional circumstances. It should not be perceived as an alternate method of qualification open to everyone. There are specific circumstances that might warrant a Q exam, and the decision to offer one is subject to a vote of the faculty.

The Faculty may vote in favor of offering a Q exam provided the following conditions are met:

- No core courses have been waived
- The student has no more than one core course for which the grade was below a B-, and for which the qualifying exam score (if taken) was below 40%.
- The student has a research advisor who has agreed to supervise future research and has presented a credible plan regarding financial commitments.

If a student is offered a Q exam, the Graduate Curriculum Committee will assign one or more questions addressing the perceived areas of weakness. The GCC will also provide a list of topic areas in which the student is perceived to have a deficit. The student must provide written answers to the questions one week before the exam, and come prepared to discuss, in chalk-talk format, any of the solutions. Most importantly, the student must also be prepared to answer questions in any of the topic areas indicated by the GCC.

It is expected that no more than six weeks should pass between the assignment of questions and the presentation. It is also expected that the student has the opportunity to consult with the faculty member(s) who formulated the question(s).

The committee that administers the Q exam will consist of the GCC plus one faculty member chosen by the student. The faculty member chosen by the student cannot be the student’s research advisor.

For the Q exam, the GCC will:

- Inform the student of the topics to be covered in their Q exam.
- Pose one or more questions relevant to these areas.
- With the student, select the date and time of the presentation. This should be no more than 6 weeks after the questions are presented.

For the Q exam, the student should:

- Pick one faculty member, who is not their research advisor, to serve on the exam committee.
- Before the exam, spend considerable time studying the topics provided by the GCC.
- Provide the Q exam committee with written answers to the questions one week before the exam.
- Prepare a chalk-talk (no powerpoints) on all of the prepared questions.
- At the exam, expect to give a chalk-talk on one or more the prepared questions. Students will probably not be asked to speak on all the questions, assuming more than one.
- Expect the exam to last no more than 90 minutes, with no more than 30 minutes devoted to the presentation.
At the exam, expect to answer a wide range of questions on topics outlined by the GCC at the start of the Q process.

The questions at the exam are an important part of this process. Students will not only be asked about the solutions they prepared; they will be asked about anything that falls within the topic areas provided by the GCC. The problems are meant as an aid in understanding. Answers to questions posed during the exam will count for more than half of the weight of the Q exam.

At the conclusion of the presentation, all members of the Graduate Curriculum Committee will participate in a pass/fail vote where a two-thirds majority is required for a pass.

II.3.b. Oral/Research Component. The purpose of this component is to help students transition from formal coursework to engagement in research, and to develop specific skills necessary for success in research. This component can be scheduled any time after the completion of the coursework component, but no later than the 5th semester in the program. To satisfy this requirement, students must do the following:

- Choose a Chair. Before the first day of the 5th semester, students shall choose a faculty member to serve as Chair of their Research Qual Committee. Except in rare cases, this should be the same faculty member who serves as the Dissertation Committee Chair. Identifying an appropriate chair is the responsibility of the student. The chair will select one other faculty member to serve on the Research Qual Committee. The name of the chair will be communicated to the Graduate Program Director no later than September 1 before the beginning of the fifth semester. If a student has difficulty identifying a chair, they must speak with the Graduate Program Director before the beginning of the fifth semester.

- Propose a topic for a presentation. The student shall identify in consultation with the Chair, a research topic that is related to the anticipated subfield. They shall consult with the Chair of their Research Qual Committee to ensure that the topic is reasonable and the proposed presentation is of a nature and scope appropriate to a research-style seminar. It should be sufficiently broad to provide context and help the student develop familiarity with their anticipated subfield, and sufficiently narrow to give depth and focus to the presentation.

- Schedule a presentation. The presentation is expected to reflect careful study of a current topic and to demonstrate that the student has understood both the important physical concepts, and the larger scientific context of the topic under investigation. A key element is the requirement that the student consult multiple research papers to put together a cohesive discussion of contemporary work or an open problem in physics. In other words, summarizing a textbook discussion is inappropriate, as is simply giving a summary of research that the student has already completed.

- A list of references used in the study must be provided to the Research Qual Committee.

- The length of the presentation should be 30-45 minutes, and students should expect additional time, typically 15-20 minutes, devoted to discussion with the committee. It may be scheduled any time after completion of the written component of the qualifying procedure and no later than the end of the fifth semester in the program.

- Following the presentation, the Chair of the student’s Research Qual Committee will send a completed Oral Qualifying Exam Checklist to the Graduate Program Director. If the presentation is deemed inadequate, the committee may ask the student to perform
additional work, such as preparation of a short document or a second presentation, which must be completed by 15 December.

Note that the role of the Research Qual Chair is not to supervise the study, but to be a source of advice and help.

With mutual consent of the student and research advisor, the Research/Oral component of the Quals may also serve as a Dissertation Prospectus presentation. In that case, the full dissertation committee must be formed and a written prospectus document prepared on the same timeline as above, but in the format and with the content of the prospectus (see Sec. II.9). Students are strongly encouraged to use this opportunity to complete their prospectus by the end of the fifth semester.

Students are reminded that completing these milestones in a timely fashion is necessary to remain in good standing. It is their responsibility to schedule and prepare the oral quals in time to satisfy departmental guidelines.

II.4. Research Courses. Students earning a Ph.D. in physics must take three research courses, a minimum of three credit hours each, above and beyond the Core Courses. At least one of these courses must be from a research category different from that of the student's dissertation. The purpose of this requirement is to provide both breadth and depth to a student’s expertise.

Research area courses are usually Physics courses numbered in the 700’s or 800’s. With prior permission of the Graduate Program Director other courses may suffice.

Advanced courses can be divided into four broad categories.

a) Condensed Matter Physics (including Biophysics): any 700 - 800 level course taught by a faculty member identified with the Condensed Matter or Biophysics Group.

b) Particle/Nuclear/Gravitational Physics: any 700 - 800 level course taught by a faculty member identified with the Nuclear Group, the High Energy Experimental Group, or the Particle and Gravitational Theory group.

c) Technique courses: courses in which the primary emphasis is to provide students with a useful skill. Examples: advanced computational techniques courses like Astronomy 723.

d) Advanced courses (600 - 800 level) taken outside the Department.

Courses in categories (a) and (b) automatically qualify as research area courses. The Graduate Program Director may accept a course from categories (c) or (d) upon review of the course syllabus. Requests to use a course towards this requirement should be made prior to taking the course.

At least one of the three required courses must be from outside the broad research area of the student. Typically this means that a student whose research falls into broad category (a) above must take a course from category (b) and vice versa. With permission of the Graduate Program Director, a course from category (c) or (d) may suffice. Keep in mind that the purpose of this requirement is to provide breadth in expertise.

The other two research area courses may lie within the student's broad area of research, but only one of them can be directly related to the student's research project. If there is doubt about the
appropriateness of a particular course, the Graduate Program Director makes the decision and should be consulted prior to taking the course.

To complete this requirement, students must fill out a Research Area Course Requirement form, which should then be forwarded to The Graduate Program Manager or Graduate Program Director. The Graduate Program Director must sign the form indicating agreement that this requirement has been satisfied. The Graduate Program Director should be consulted well in advance if there is any question about whether or not a particular course satisfies these requirements.

Independent Study Courses: Graduate students may also ask that an independent study course be used to satisfy any of these requirements. The Graduate Program Director (GPD) is the instructor-of-record for all independent study courses and so all requests for independent study must go through the GPD. To enroll in independent study, the student and their proposed independent study director (faculty member) should decide together on (1) the topic of the course (1-3 sentences); (2) the level of the course (696, 796, or 896); (3) the number of credits; (3) the number of hours/week expected work on the course; (4) the number and type of meetings (for example, skype or face-to-face meetings once a week); (5) the method of evaluating performance in the course. This information must be recorded in an email from the student to the GPD, with a cc to the faculty directing the independent study. The instructor is also welcome to send the email, with a cc to the student. The GPD will then forward their approval to the Graduate Program Manager who will enroll the student in the course.

II.5. Residency. As per UMass graduate school rules, a minimum of two consecutive semesters in residence at the University, each with eight credits, is required. The GPD cannot waive this requirement; all students must satisfy it.

II.6. Teaching. All degree candidates are required to perform teaching (via a Teaching Assistantship) in the department. A waiver of this requirement may be requested from the Graduate Program Director. The purpose of this requirement is to give all graduate students experience with instruction, to help develop their communication and interpersonal skills, to prepare them for work in a collaborative environment, and to give them the opportunity to learn from their students.

II.7. Research Advisor. Students are expected to identify a Research Advisor, who has agreed to guide and supervise their Dissertation research, no later than September 1 after completing the written/course component of the Qualifying Procedure, and preferably much earlier than that. The student should provide the proposed Research Advisor with a Research Advisor Confirmation Form, which should be signed and returned to the Graduate Program Manager.

The prior permission of the Graduate Program Director is required for approval of Research Advisors outside of the Physics Department.

As noted above in Sec. II.3, the Research Advisor also normally serves as chair of the Research Qual Committee.

II.8. Ph.D. Dissertation Committee. Students are expected to form a dissertation committee consisting of the research advisor, two other members of the physics faculty, and one university
faculty member from outside the student's program. After the members have agreed to be on the Committee, the student must notify the Physics Graduate Program Manager by email no later than twenty months after completing the written/course component of the Qualifying Procedure and preferably much earlier, at the same time that the Research Advisor is identified. The Graduate Program Manager will then prepare the required memo to the Graduate School.

**II.9. Ph.D. Dissertation Prospectus.** Students shall submit a dissertation prospectus (also called dissertation proposal), complete with signature sheet, to the Graduate Program Manager no later than twenty-four months after completing the written/course component of the Qualifying Procedure.

The goal of the prospectus is: (1) to provide the student with experience in research design generally; (2) to specifically design their thesis work; (3) to familiarize the student with the literature and context surrounding their proposed work; and (4) to serve as an agreement with the Research Advisor concerning the scope of the Dissertation work.

Completing the prospectus requires the following:

- An oral presentation of the prospectus should be scheduled at a time convenient for the members of the Dissertation Committee.
- The written prospectus should be prepared well before the oral presentation. It must be formatted as a dissertation (https://www.umass.edu/graduate/form/guidelines-thesis-and-dissertation), including title, abstract, signature sheet, project description (maximum of ten pages), bibliography (full citations).
- The written prospectus should be distributed to all members of the Dissertation Committee prior to the presentation, typically at least one week.
- The length of the presentation should be 30-45 minutes, with an additional 15-20 minutes allotted for discussion with the committee. In addition to the dissertation committee, interested members of the Department may attend the presentation.
- The student must bring a blank copy of the signature page, and a copy of the Dissertation Prospectus Checklist to the presentation.
- The Committee must fill out the Dissertation Prospectus Checklist and sign the signature sheet in black ink to indicate approval of the Prospectus.
- The original hard-copy document and signature sheet, and an electronic copy, must be delivered to the Graduate Program Manager, who will hand delivery it to the Graduate School.

It is important to note that the dissertation prospectus must be successfully defended and submitted at least seven months before the dissertation defense.

Students are reminded that completing these milestones in a timely fashion is necessary to remain in good standing. It is the student’s responsibility to schedule and prepare the prospectus in time to satisfy both department and graduate school deadlines.

**II.10. Dissertation Credits.** The Graduate School requires that students register for 18 or more dissertation credits before their completion of the Ph.D. program.
II.11. Dissertation. A written dissertation is the final product of a Ph.D. It is a student’s unique and original scholarly work and something they should take great pride in. It places their contribution to science in perspective and documents their efforts. The dissertation must be unanimously approved by the members of the Dissertation Committee. Approval requires a successful “defense,” meaning formal acceptance of the work by the Dissertation Committee after the members have thoroughly reviewed the written document and had an opportunity to question the student at a seminar-style oral presentation of the work.

- Ph.D. Defense Announcement. A month before the final defense, email the Physics Graduate Program Manager your defense details (date, time, room, thesis title) to be forwarded to the Graduate School. The information needs to be received by the Graduate School (from the Graduate Program Director) at least four weeks before the defense.
- Format. The dissertation must be formatted correctly before it will be reviewed by the Dissertation Committee. See https://www.umass.edu/graduate/form/guidelines-thesis-and-dissertation for guidelines.
- Distribute the Dissertation to Committee Members. The dissertation should be prepared and submitted to the Dissertation Committee will before the defense date. A minimum of two weeks is recommended.
- Signature page. Students should bring a blank signature page to the defense. Be aware that if revisions need to be made to the Dissertation, it is not always signed at the defense.

Students should work to minimize the need for revisions. Graduate school guidelines call for only minor revisions to the Dissertation after the defense. Students should please be cognizant of this and provide a polished, well-formatted, carefully structured and well written document to their Committee. Research Advisor’s and colleagues’ input and editorial comments should be sought well in advance, and the Dissertation should be proofed several times before it is submitted to the Dissertation Committee.

After a successful defense, the dissertation must be submitted electronically. The original signature sheet (signed in black ink) should be submitted to the Graduate Program Manager along with the eligibility form. The Graduate Program Manager will deliver all documents to the Graduate School.

II.12. Timeline for Progress towards the Ph.D. The following is the expected timeline for successful completion of a Ph.D. It is never a problem to complete the various milestones early. Delays require the agreement of the student’s academic advisor and/or the Graduate Program Director.

First year
- Fall semester: P605 Math Methods and P601 Classical Mechanics
- Spring semester: P614 Quantum I and P606 Classical Electrodynamics

Second year
- Fall semester: P602 Statistical Mechanics and P615 Quantum Mechanics
- Spring semester: Initiate work with a research group and take one or two research area courses (see requirements in Sec. II.4).
- Summer: Students are required to have chosen a Chair (who typically will become the Ph.D. research advisor) for the research/oral component of the Qualifying Procedure by the end of the summer (prior to the beginning of the Fall semester).
In consultation with the Chair, the student should choose a topic and set a date for the oral exam. The name of the Chair, the chosen topic and the date of the oral should be conveyed to the Physics Graduate office no later than September 1.

Third Year
- Before end of Fall semester: Research/oral component of the Qualifying Process
- This is a good time to take additional research area courses, to set up a Ph.D. Dissertation Committee, to plan a Ph.D. Prospectus, and, of course, to perform research.

Fourth Year
- Before the end of September: Set up a Ph.D. Committee
- Before the end of January: Present and submit a Ph.D. Prospectus.
- During this year, it is expected that the student will take thesis credits, take research area courses, if appropriate, and continue to take courses to fulfill the Research Area Course requirement

Satisfactory Progress is most directly demonstrated by meeting all the deadlines described in Section II and this timeline. Note that after passing the qualifying procedure, it is expected that the student will aggressively pursue joining a research group in his/her area of interest, if they have not already done so. If there are concerns about how to go about this, the student is encouraged to meet with his/her academic advisor and/or the Graduate Program Director.
III. Master’s Program Requirements

The M.S. program is designed to be completed in two years or less. It is primarily course-based, although a thesis option is available to some students by permission. Students applying directly to the program are assumed to be pursuing a course-based degree. At this time, the thesis-based option is not available to UMass students in the accelerated M.S. program, described in Sec. III.6.

The course-based M.S. program is designed either as a “springboard” to a Ph.D. program, or as a stepping stone on the way to a career in industry.

Springboard to a Ph.D.: A M.S. in physics provides students with the same coursework provided to Ph.D. students. It permits students who are not yet sure if they want to pursue a Ph.D. the opportunity to satisfy typical coursework requirements. M.S. Students interested in research typically take the same sequence of courses that Ph.D. students take.

Stepping into industry: For students interested in a technical career in the private or public sector, an M.S. in Physics provides an opportunity to learn the basic of optics, electronics, mechanics, and modeling while continuing to develop cross-cutting analytic skills. It also provides students with the opportunity to develop depth in one or more topics through independent study.

Students in the terminal M.S. program are ineligible for teaching or research assistantships in the Physics Department, or any other department within the Five-College system. These positions are reserved for Ph.D. students. Students who are certain they want to pursue a career in physics research should apply to the Ph.D. program.

III.1. General requirements.

Course-based program: The requirements for the course-based M.S. degree in Physics consist of the following:

1. a minimum of 30 graduate credits (course number 500 or higher);
2. at least 12 credits at 600-level or higher;
3. at least 21 of the credits must be in Physics;
4. at least 21 of the total credits must be for a letter grade, and the GPA must be at least 3.0;
5. independent study is allowed, to a maximum of 6 credits.
6. a maximum of 6 credits of graduate-level coursework taken at another institution can be transferred to the UMass M.S. program, subject to approval by the Physics Graduate Program Director.

Note that for the accelerated M.S. more credits may be transferred. See below.

Thesis-based program: This program is primarily for PhD students who opt not to continue in the PhD program but who would like recognition for their work. In rare cases, students in the course-based program may request a change to the thesis program, although UMass students in the accelerated M.S. program are currently ineligible for the thesis option.
The requirements for the thesis-based M.S. degree in Physics consist of the following:

1. a minimum of 30 graduate credits (course number 500 or higher);
2. at least 15 credits at 600-level or higher Physics courses;
3. at least 21 of the credits must be in Physics;
4. at least half of the total credits must be for a letter grade, and GPA must be at least 3.0;
5. independent study is allowed, to a maximum of 6 credits;
6. between 1 and 6 thesis credits are required;
7. five of the Physics courses must have a grade of B or better;
8. a maximum of 6 credits of graduate-level coursework taken at another institution can be transferred to the UMass M.S. program, subject to approval by the Physics Graduate Program Director;
9. one course in the Quantum Mechanics sequence, or equivalent, is required;
10. a Masters thesis and thesis defense is required.

III.2. Pass/Fail Grades. The Graduate Program Director must provide approval before a course may be taken as Pass/Fail.

III.3. Independent Study credits are allowed, up to a maximum of 6 credits. All Independent Study credits must be approved by the Physics Graduate Program Director, who will ask that a comprehensive plan be drawn to ensure that the credits earned reflect a sufficiently high level of study or training and that the means of evaluating performance are appropriate.

Physics 696, independent study, is offered over the summer for students who wish to make use of that option to accelerate completion of their degree.

To enroll in independent study, the student and their proposed independent study director (faculty member) should decide together on (1) the topic of the course (1-3 sentences); (2) the level of the course (696, 796, or 896); (3) the number of credits; (3) the number of hours/week expected work on the course; (4) the number and type of meetings (for example, skype or face-to-face meetings once a week); (5) the method of evaluating performance in the course. This information must be recorded in an email from the student to the Graduate Program Director (GPD), with a cc to the faculty directing the independent study. The instructor is also welcome to send the email, with a cc to the student. The GPD will then forward their approval to the Graduate Program Manager who will enroll the student in the course.

III.4. Transfer of Credit. For regular MS students, a maximum of 6 credits of graduate-level coursework taken at UMass or at another institution can be transferred to the UMass M.S. program. Courses taken as Pass/Fail cannot be transferred and the minimum grade for transferable credits is a B. There are important other limitations to how the transferred credits can be used: please see Graduate School’s Graduate Student Handbook for more details (see the section on Education Records for transfer credit policies).

For accelerated MS students, a maximum of 12 credits of graduate work taken while enrolled as an undergraduate may be counted toward the Master's degree. Up to six of these may also be used to satisfy the baccalaureate degree. Students are therefore encouraged to apply early, before they have taken graduate level courses, and to be careful not to use more than 6 credits from advanced classes to satisfy their undergraduate degree.
III.5.a Sample Programs: three semester degrees.

These programs take into account that international students must take at least 9 credits per semester.

1. Focus on preparing for a Ph.D. program in condensed matter physics
   Fall Semester 1
   • Physics 601 (Classical Mechanics: 3 cr);
   • Physics 605 (Mathematical Methods in Physics: 4 cr);
   • Physics 531 (Electronics for Scientists I: 4 cr);
   • 1 credits seminar course, e.g., 691G Professional Development
   Spring Semester 2
   • Physics 606 (Classical Electrodynamics: 4 cr);
   • Physics 614 (Quantum Mechanics I: 3 cr);
   • Physics 558 or 715 (Solid State Physics: 3 cr) or
   • 1 credits seminar courses e.g., 860S Solid State Seminar
   Fall Semester 3
   • Physics 602 (Statistical Mechanics: 3 cr);
   • Physics 615 (Quantum Mechanics II: 3 cr);
   • Physics 797S (Topics in Soft Matter: 3 cr);
   • 1 credits seminar courses e.g., 691A Colloquium
   Total credits: 33

2. Focus: preparing for a Ph.D. program in nuclear/particle physics
   Fall Semester 1
   • Physics 601 (Classical Mechanics: 3 cr);
   • Physics 605 (Mathematical Methods in Physics: 4 cr).
   • Physics 714 (Introduction to High Energy Physics: 3 cr).does this have prereqs?
   • 1 credits seminar course, e.g., 691G Professional Development;
   Spring Semester 2
   • Physics 606 (Classical Electrodynamics: 4 cr);
   • Physics 614 (Quantum Mechanics I: 3 cr);
   • Physics 852 (Special Topics in High Energy Physics: 3 cr); prereqs?
   • 1 credits seminar courses e.g., 860N Nuclear Seminar
   Fall Semester 3
   • Physics 602 (Statistical Mechanics: 3 cr);
   • Physics 615 (Quantum Mechanics II: 3 cr);
   • Physics 531 (Electronics for Scientists I: 4 cr);
   • 1 credits seminar courses e.g., 691A Colloquium
   Total credits: 33

3. Focus: Instrumentation, for students preparing for career in industry
   Fall Semester 1
   • Physics 531 (Electronics for Scientists I: 4 cr);
   • Physics 605 (Mathematical Methods in Physics: 4 cr);
• Physics 697L (Topics in Laboratory Techniques: 3 cr);
• 1 credits seminar course, e.g., 691G Professional Development;

Spring Semester 2
• Physics 553 (Optics: 4 cr);
• Physics 606 (Classical Electrodynamics: 4 cr).
• Physics 558 (Solid State Physics: 3 cr);
• 1 credits seminar courses e.g., 860S Solid State

Fall Semester 3
• Physics 602 (Statistical Mechanics: 3 cr);
• Physics 796 (Independent Study in a Lab: 4 cr);
• Physics 597D (Topics in Statistics and Data Analysis: 3 cr);
• 1 credits seminar courses e.g., 691A Colloquium

Total credits: 35

III.5.b Sample Programs: four semester degrees.
Master’s students who need to work a part time job, who prefer a lighter course load, or who want to take advantage of the less expensive tuition may opt for these 8 credits per semester programs.
1. Focus on preparing for a Ph.D. program in condensed matter physics
   Fall Semester 1
   • Physics 601 (Classical Mechanics: 3 cr);
   • Physics 605 (Mathematical Methods in Physics: 4 cr);
   • 1 credits seminar course, e.g., 691G Professional Development.

   Spring Semester 2
   • Physics 614 (Quantum Mechanics I: 3 cr);
   • Physics 553 (Optics: 4 cr);
   • 1 credit seminar course, e.g., 860.

   Fall Semester 3
   • Physics 602 (Statistical Mechanics: 3 cr);
   • Physics 615 (Quantum Mechanics II: 3 cr);
   • Physics 797S (Topics in Soft Matter: 3 cr); or Physics 531 (Electronics for Scientists I: 4 cr); or Physics 697L (Topics in Laboratory Techniques: 3 cr); or Physics 696 (Independent Studies: 2-3 cr).

   Spring Semester 4
   • Physics 606 (Classical Electrodynamics: 4 cr);
   • Physics 558 or 715 (Solid State Physics: 3 cr) or
   • Physics 5xx (Biophysics: 3cr).

2. Focus: preparing for a Ph.D. program in nuclear/particle physics
   Fall Semester 1
   • Physics 601 (Classical Mechanics: 3 cr);
   • Physics 605 (Mathematical Methods in Physics: 4 cr).
   • 1 credits seminar course, e.g., 691G Professional Development.

   Spring Semester 2
   • Physics 606 (Classical Electrodynamics: 4 cr);
• Physics 614 (Quantum Mechanics I: 3 cr);
• 1 credit seminar course, e.g. 860.

Fall Semester 3
• Physics 602 (Statistical Mechanics: 3 cr);
• Physics 615 (Quantum Mechanics II: 3 cr);
• Physics 531 (Electronics for Scientists I: 4 cr); or Physics 714 (Introduction to High Energy Physics: 3 cr); or Phys 597D (Statistics and data analysis: 3 cr).

Spring semester 4
• Physics 852 (Special Topics in High Energy Physics: 3 cr); prereqs?
• Physics (Quantum Field theory 1)

3. Focus: Instrumentation, for students preparing for career in industry
Fall Semester 1
• Physics 697L (Topics in Laboratory Techniques: 3 cr)
• Physics 605 (Mathematical Methods in Physics: 4 cr);
• 1 credits seminar course, e.g., 691G Professional Development.

Spring Semester 2
• Physics 553 (Optics: 4 cr);
• Physics 606 (Classical Electrodynamics: 4 cr).

Fall Semester 3
• Physics 602 (Statistical Mechanics: 3 cr);
• 1 credit seminar course, e.g. 860
• Physics 531 (Electronics for Scientists I: 4 cr).

Spring Semester 4
• Physics 614 (Quantum Mechanics I: 3 cr);
• Physics 558 (Solid State Physics: 3 cr); or
• Physics 696 (Independent study : 3 credits).

III.6. The Accelerated MS Program

Juniors and Seniors currently working towards BA or BS degrees with a major in Physics at UMass Amherst may apply to the Accelerated MS program, also called a 4+1 program. This program provides a route for motivated students to obtain both their Bachelor’s and Master’s degrees in 5 years.

The standard application procedures for admission to graduate programs apply to the Accelerated Master's Degree Option. Students are encouraged to apply by November 30 of their junior year and receive a conditional admission to the Accelerated Master's Degree Option for the semester after they complete their baccalaureate degree. Students may opt to apply later, with alternate deadlines of April 1 in their Junior year or November 30 of their Senior year. Students are strongly encouraged to use the earlier deadline because of rules around transfer credit noted below.

To apply to the program, students must have completed at least two 400 level courses by the end of the semester in which they apply. Decisions for the November deadline will be made in late January. Decision for the April deadline will be made in late May.
Admission to the graduate program remains conditional until the applicant completes the baccalaureate degree and fulfills the requirements of the Graduate School and graduate program for admission.

The degree requirements are the same as described for the course-based MS program, but with one important difference: A maximum of 12 credits of graduate work taken while enrolled as an undergraduate may be counted toward the Master's degree. Up to six of these may also be used to satisfy the baccalaureate degree. Students are therefore encouraged to apply early, before they have taken graduate level courses, and to be careful not to use more than 6 credits from advanced classes to satisfy their undergraduate degree.

At this time, the M.S. thesis option is not available to accelerated MS students.
IV. Expectations

The requirements for the MS and Ph.D. enumerated above are the minimal steps to achieve a degree. There are many other opportunities for professional growth in which graduate student participation is expected. These activities help students to establish their general competence, breadth and depth as scientists; aid in building life-long professional networks; and teach interpersonal and communication skills that help students become leaders in their fields.

Additionally, it is important for graduate students to remember that they are an integral part of the department, and front-line representatives of UMass Physics at conferences they attend and classes they teach. All students are expected to develop an appreciation and respect for the diversity of scientific inquiry, and to contribute to a welcoming and professional climate for the diverse student body at UMass.

IV.1. Seminars and Colloquia. Students are expected to attend, participate, and help organize regular and ad-hoc seminars and journal clubs relevant to their dissertation work, as well as the department colloquium.

IV.2. Intellectual Curiosity. Beyond what is required in the way of seminar attendance, students are expected to read professional literature, attend additional seminars, participate in department activities and discussions, and/or take other steps to stay informed on current events in physics or science generally.

IV.3. Community. Students are expected to participate in the physics community at UMass and beyond. This might include (for example) active participation in the Physics Community Organization, volunteering to represent the department on University or College committees, serving on departmental committees, serving on the GEO, participating in outreach, and/or joining the American Physical Society or other societies as appropriate.

IV.4. Grantsmanship. Students are strongly encouraged, and in some cases expected, to seek and apply for external sources of funding. This includes smaller travel grants for attending conferences and meeting with collaborators, as well as larger fellowships offered by, e.g., the NSF, DOE, and other organizations.

IV.5. Professional Development. Students are expected to avail themselves of the many workshops and retreats offered by the Graduate School’s Office of Professional Development (https://www.umass.edu/graduate/professional-development). Among other things, they offer writing retreats, and workshops to help students improve their teaching, writing, communication and leadership skills.

IV.6. Individual Development Plans (IDP). All Graduate Students are encouraged and expected to assemble an Individual Development Plan. An IDP is tool to help students to define their values, interests, and strengths, and to use this information to make career decisions. The exercise helps students identify challenges and opportunities, and an important aspect of the IDP is to set goals and to implement these goals over a specific time frame. These goals can then be discussed with mentors and incorporated into an annual student report (ASR). An ASR is a mechanism for graduate students to summarize their accomplishments over the prior academic year. The graduate school has resources and seminars to help you design an IDP. See
For other examples of plans, see Purdue IDP (for physics grads in years 4-6) and AAAS IDP.

**IV.7 Expectations of Research Assistants (RAs).** Physics RAs are paid for up to 20 hrs per week. The money for these appointments almost always comes from funding agencies (such as the National Science Foundation and Department of Energy) that require the funded time is spent on the funded project. In physics, it is common for this work to directly align with a student’s dissertation work. However, the importance of a 20 hour appointment is to ensure that students have time to work on their dissertation, even when the funded research is not perfectly aligned. It also ensures the student has time to attend seminars and meetings, study for coursework, engage in professional development, and generally spend time acquiring skills needed for their own education and future career. The time spent on the funded project may involve anything the Principal Investigator on the grant (typically the Research Advisor) needs done as part of that project, including helping with laboratory management and cleaning, safety, hardware, and software; and preparing laboratory documents (such as standard operating procedures), presentations, reports, and papers. In physics we are fortunate because, unlike in many other Departments and Colleges, most RA funding directly overlaps student dissertation work. Whether or not a student’s funding has 100% overlap with their dissertation, students will nearly always be asked to spend at least some fraction of their funded time doing things that benefit the larger project.

When traveling to conferences, workshops, and meetings to present their work or participate in other ways, RAs are reminded that their preparedness and their professional demeanor directly affect how the wider research community views the UMass Physics program and their own group. That in turn affects the perceived value of their own degree. The Department counts on and expects students to be good ambassadors for our program.

Research Assistants are encouraged and expected to look for opportunities to present their work, apply for travel grants, and engage with the wider scientific community at UMass and in their professional societies. They are encouraged to participate in seminars, ask questions, visit with speakers, and serve on departmental committees. In turn, they should expect to feel welcomed and supported at all departmental functions and on a variety of committees.

**IV.8 Expectations of Teaching Assistants (TAs).** Teaching Assistants are an invaluable resource for our students and a vital part of the department’s teaching team. The main purpose of a public university is education, and TAs serve at the frontline of this mission. Their professional demeanor reflects on the department and affects how the department is perceived by the students, their parents, and taxpayers in Massachusetts.

Funding for TAs generally comes from the state, for the purpose of teaching and teaching support, or directly from student tuition.

TA roles are varied and not all TAs have the same duties. As required by their particular assignment, TAs may be required to plan lessons; design or lead labs or team-based-learning modules; attend class or meetings with the instructor; prep for lab or demonstrations; design lab exercises; observe labs; run labs independently; write quizzes; grade; proctor exams; and hold office hours; lead discussion or review sessions; and do clerical work, such as copying and
uploading grades, required of the course.

Regardless of specific assignments, TAs are expected to:

- check their email at least once a day for communications from students and the course instructor;
- respond promptly to such communication;
- arrive a few minutes before the appointed class, discussion, lab or office hour;
- be organized and prepared upon arrival;
- stay a few minutes afterwards to help with whatever needs to be done or answer student questions;
- be attentive and mentally present during the class/lab/office hour;
- be responsible for finding a substitute if needed, and communicating the change to the instructor;
- spend time between labs/classes/office hours on preparation;
- attend any meetings required by the course, lab instructor, or department;
- communicate concerns, problems, challenges, or scheduling conflicts to the course instructor;
- get help as needed;
- give appropriate feedback and wise criticism to students, to the extent possible in the time limitations of their appointment.

Except in the case of office hours with no students present, TAs should never be doing their own work during class/lab/office hours, nor should they be distracted by a cell phone or computer.

Office hours in the Physics Help Center are required of most TAs. When in the Help Center, TAs should be respectful of other TAs and students in the room; they should be available to answer questions from any student requesting help, whether in their course or not. If a TA cannot answer a question, they should get help either from another TA or the course instructor. In some cases, students taking a specialized course (like Fundamentals of Sound for Speech and Communication Disorders) might ask questions that a typical Physics TA cannot answer. In that case, the students should be referred to the course TA whose name is likely on the door to the Help Center.

Failures of organization and preparation happen; in that case TAs are expected to deal with the situation gracefully and with respect for the students and their departmental colleagues.

To help facilitate a supportive climate for all students, TAs should make a concerted effort to learn their students’ names. They should recognize that not all students are physics majors: students at UMass come with an enormous variation in background, skill, and knowledge. TAs should recognize and value these differences and meet each student “where they are” in terms of understanding and abilities. It helps to always affirm that a students’ questions are good and valid.

If a TA cannot answer a student’s question, their first response should be “good question!” They should be honest about their inability to answer, promise to get back to the student with an answer, and then follow through on the promise.
TAs should be cognizant of their own biases, and make efforts to counter them in their approach to students. They should listen carefully to student’s questions and concerns, give appropriate feedback and wise criticism.

As a TA, a student’s input on a course is invaluable. TAs should communicate with the course instructor about things that work, things that don’t work, and ideas or suggestions for change.

Finally, TAs are encouraged to take advantage of the many teaching workshops and seminars available to them through the graduate school: https://www.umass.edu/graduate/professional-development/teaching.

If a TA’s workload exceeds the number of hour for which they are paid, it is their responsibility to document this by keeping track of hours worked. In that case, they should discuss the situation first with the course instructor, who should make appropriate changes.

Course instructors are expected to be respectful of TAs, be communicative and responsive to their needs and concerns. TAs should be treated as valued members of an instructional team, and instructors should be respectful of their time. Expectations for any particular course should be clearly communicated and discussed with the TA.
V. Code of Conduct and Resources
The Department of Physics strives to maintain an inclusive and respectful climate, where all of its members are valued, encouraged and supported to achieve their best. We put every effort in ensuring that our environment is free from discrimination, intimidation, humiliation, and hostility. At the same time we strive to protect scientific debate, constructive criticism, and differing opinions, when respectfully delivered and argued.

At a minimum, all academic members of the Department are required to follow the Guidelines for Professional Conduct as described by the American Physical Society

In addition, The University of Massachusetts, Amherst, has established a Student’s Code of Conduct which details expectations for all students associated with the University. The Code can be found at: https://www.umass.edu/dean_students/codeofconduct

A recent development at UMass is the institution of a consensual relationship policy, which can be found at: https://www.umass.edu/newsoffice/article/new-policy-governs-consensual

The principles, ideas, and requirements contained in the documents above hold for all members of the Department.

Despite best efforts from all involved, unwanted situations may arise in which an imbalance of power complicates resolution. The next few sections provide resources and mechanisms for preventing and responding to some of these situations. Since every incident is unique, we do not expect that these examples will cover all situations.

In all cases, a student’s first resource is the Physics Graduate Program Director (GPD). If applicable or required, the Head of the Department will intervene in cases that cannot be handled by the Physics Graduate Program Director. Beyond the level of the Department, additional resources include:

- the Dean of Students (directory), and particularly the Case Manager for Graduate Students (currently Katelyn Dreyer, interim), https://www.umass.edu/dean_students/student_services;
- the College of Natural Sciences (directory) Director of Diversity and Inclusion for Graduate and Postdoctoral Studies (currently Jennifer M. McDermott);
- the Associate Dean for Operations & Graduate Programs (currently John Lopes) in the College of Natural Sciences (directory);
- the Graduate School, (directory);

The University has also established a formal grievance procedure available to graduate students. The policy can be found on this webpage maintained by the faculty senate: https://www.umass.edu/senate/A-D. Look for the first link under “Academic Grievance Procedures.”

V.1. Sexual Misconduct. Many University employees are “Responsible Employees” under Title IX, meaning that they are mandatory reporters of sexual discrimination, harassment, or violence (generically referred to as “sexual misconduct”). As a TA or RA you are probably not in this category, but you are still encouraged to report. For detailed information on Title IX reporting and answers to frequently asked question, please refer to the following links:
FAQs for students
FAQs for faculty and staff
Options for Reporting

Sexual Bias or Discrimination: The department recognizes that women in physics have been historically underrepresented both in the field and in the department. The American Physical Society has issued a brief statement on the Status of Women in Physics, https://www.aps.org/policy/statements/15_2.cfm, which reads in part:

Enabling the full participation of women in physics requires improving how all physicists are treated, with particular attention to practices and assumptions that discourage women from joining and remaining in the profession. Well-intended efforts can fall short due to unintended and unconscious biases. The APS encourages leaders in industry, government, and academia to adopt, monitor, and refine systemic policies and practices that improve the recruitment, retention and treatment of women.

On an individual level, all members of the Department are expected to take this to heart and help explore policies and implement practices that improve the climate for women.

Sexual Harassment or Abuse: Resources are available on campus for students who need support or protection from violent or abusive situations. Lists of resources can be found on the “Options for Reporting” link above and here: http://www.umass.edu/titleix/title-ix-campus-resources. A particularly useful one-page summary of resources is here: https://www.umass.edu/umpd/sites/default/files/sexual_violence_resource_guide-2019.pdf.

Additional information can be found on the website http://www.umass.edu/titleix/.

It is important to emphasize that while not all university employees are required to report Title IX violations, as a bystander, the worst thing you can do is to do or say nothing.

If you are a victim, please realize that discussing an incident with a faculty or staff member who is a mandatory reporter will prompt their contacting either the Dean of Students office, or the Office of Equal Opportunity and Diversity. Your privacy will always be protected, but, with important exceptions, under title IX, University employees who are mandatory reporters cannot guarantee confidentiality. For an explanation of privacy vs. confidentiality see https://www.umass.edu/dean_students/title-faq.

Certain campus resources generally do guarantee confidentiality, although you should always ask to be sure. These include:

- Psychological counselors (including counselors/advocates at the Center for Women and Community and the Center for Counseling and Psychological Services)
- Health care providers (including medical professionals at University Health Services)
- Attorneys (including Student Legal Services)
- Clergy

V.2. Discrimination or harassment based on LGBTQIA+ status. The Department recognizes that the current political atmosphere in the United States is a particularly difficult one for LGBTQIA+ individuals, whose rights are often not protected in the same way as their straight, cis-gendered colleagues. The University Affirmative Action and Nondiscrimination Policy, https://www.umass.edu/diversity/data-policies/policies, is, however, clear on its inclusion of sexual orientation, gender identity and expression. Faculty and students alike are expected to
abide by these policies and help create a welcoming environment and supportive climate for everyone.

Physics department faculty are encouraged to familiarize themselves with the publication “Supporting LGBT+ Physicists & Astronomers: Best Practices for Academic Departments.” Faculty, staff, and students are encouraged to read the APS report: "LGBT Climate in Physics: Building an Inclusive Community".

If you are a victim of harassment or discrimination there are resources for you on campus, many of which can be found on the website of the Stonewall Center, https://www.umass.edu/stonewall/, which is itself a resource for Lesbian, Gay, Bisexual, Trans, Queer, Intersex, and Asexual (LGBTQIA+) students and faculty.

If for any reason you would like an ally on the faculty, the organization lgbt+physicists maintains a list of allies and out physicists on which you can find many UMass Physics faculty members: https://lgbtphysicists.org/outlist.html.

V.3. Discrimination, bias, or harassment based on race, ethnicity, disability status, religion, creed, age, marital status, national origin, mental or physical disability, political belief or affiliation, or veteran status. The Department also recognizes that other minority members, and particularly African-American and Hispanic individuals, have faced substantial barriers in Physics and remain underrepresented in the field and the Department. We emphasize again that all faculty and students are required to abide by both University and Professional standards, and that harassment and discrimination will not be tolerated.

Additionally, the APS has issued a joint statement on diversity in physics that should be familiar to Department members: https://www.aps.org/policy/statements/08_2.cfm. Links to the National Society for Hispanic Physicists and the National Society for Black Physicists can also be found on that page.

If you are a victim of illegal harassment or discrimination you are encouraged to contact the UMass Equal Opportunity Office https://www.umass.edu/eod/ for guidance. Their statement of Grievance Policies and Procedures has both formal and informal procedures for dealing with discrimination.

Frequently implicit bias and more subtle forms of discrimination prove to be the most vexing barriers to success. All department members are encouraged to familiarize themselves with the causes and effects of unconscious bias, and take steps to minimize bias in their interactions. The University supports these efforts through trainings and workshops. A good starting point is here: https://www.umass.edu/wld/unconscious-bias.

V.4. Emotional Abuse/Bullying. Chancellor Subbaswamey’s statement on workplace bullying, and University-wide procedures for dealing with it, can be found here: https://www.umass.edu/gateway/workplacebullying.

In most cases, local and informal remedy(ies) should be sought. If you are a victim of bullying or emotional abuse, the incident(s) should therefore first be reported to the Graduate Program Director or Department Head.

The Graduate Program Director or student may request a meeting with the perpetrator and the Department Head to discuss issues and possible remedies, which may include, in severe cases, filing a formal grievance following the procedures outlined at the above link on workplace
bullying.

V.5. Conflict between Supervisor or Advisor and graduate student. While differing points of view and passionate scientific debate are important to scientific discovery, conflicts that become personal or that involve, *e.g.*, progress towards a degree, mismatched expectations, or interpersonal style can be problematic. Such conflicts cause particular anxiety for students because of the inherent power imbalance. Faculty should generally strive to be sensitive to different personalities, abilities, and communication styles of their students and often appreciate and act upon constructive feedback. However, on the rare occasion that a conflict arises that cannot be solved via frank discussions between the supervisoradvisor and student, two courses of action may be available.

**Students not yet admitted to Ph.D. candidacy.** If the conflict is with a TA Supervisor or Research Advisor who is not their Faculty Advisor, the student should first request a meeting with their Faculty Advisor or Graduate Program Director (GPD). If the conflict is with the Faculty Advisor, the student should seek a meeting with the GPD or Department Head. The student should come to the meeting prepared to discuss the nature of the conflict. Students are also encouraged to bring to the meeting their thoughts on desired outcomes and/or any ideas for resolving the conflict; however this is not required. The important thing is to meet with someone who can help address the problem.

As discussed during the initial meeting, the Faculty Advisor/GPD/Department Head may also: seek additional input from the supervisoradvisor; set up a joint meeting with the supervisoradvisor; talk separately with the supervisor; help update performance goals for the student or performance expectations from the supervisor; bring in a third partyexpert to help facilitate discussions and solve specific problems. In extreme cases, the student may be advised to seek a new advisor-supervisor, have a TA assignment changed, or be assigned a co-supervisor, depending on the situation.

To ease anxiety, it should be recognized that a single Faculty member has limited decision power regarding an individual student. As described in other sections of this document, admission to Ph.D. candidacy is the result of a holistic review by the entire Graduate Faculty, where performance and accomplishments in coursework, journal clubs, research, research presentations, and exams are all considered. The entire Graduate Faculty vote on admission to candidacy of each student.

**Students who have been admitted to Ph.D. candidacy.** In the event of conflict with either the Research Advisor or the Dissertation Committee chair (who are generally the same person), the first recourse for the student is to consult with other members of the Dissertation Committee, and ask them for guidance and course correction as necessary. The Dissertation Committee remains involved with the student’s scientific well-being and progress from the moment the Committee is formed until the student successfully defends their dissertation. Dissertation Committee members may request that the Faculty Supervisor/Advisor implements updates to the research plan to help the student towards a successful completion of the Program. For this reason, it is in the student’s best interest to form a Dissertation Committee as soon as they are admitted to Ph.D. candidacy.

In case the Dissertation Committee is unable to resolve the issue, the Graduate Program Director (GPD) should be consulted. The GPD may elect to confer with the supervisor or advisor, bring in a third partyexpert to help facilitate discussions or solve specific problems,
or recommend specific action to be taken by the supervisor or student.

In extreme cases, where it makes a specific and tangible difference to the student’s ability to graduate in a timely manner, the student may be advised to seek a new Dissertation Committee Chair from other faculty on their Dissertation Committee. Such advice will be made only after a meeting of the Dissertation Committee and the Graduate Program Director, and there must be general assent that any change will be beneficial to the student.

It is worth noting that in Physics it is typical, but not required, that the Research Advisor is also the Dissertation Committee Chair. Only in rare circumstances will that not be the case. While there are exceptions, changing Research Advisors is generally not possible without changing research projects, since students may rely on their Research Advisor for lab or facilities access, salary, or research funds. Nor can a Research Advisor be removed from the Dissertation Committee while a student continues work on a project that was or is supported by that advisor. However, it is expected that all members of the department will behave in a professional manner and will take appropriate steps, as per the process outlined above, to remediate conflicts.

In cases where the parties feel that the conflict or source of conflict has not been addressed fully by the above process, either or both can contact the Ombuds Office to facilitate discussion and mediate disputes. Please, consult their website for specific information on the services provided (https://www.umass.edu/ombuds/).

V.6. Intellectual Property and Publication. In Physics it is common, but not mandatory, for junior researchers to take leadership positions in publications if the junior researcher has produced most of the work reported in the paper, even if the idea for the project originates with a more senior researcher. This can be the case, for instance, of graduate students working with their advisors.

For publications, all students in the Program are expected to abide by the same standards of professional ethical conduct as the Faculty. When submitting a paper or report for internal review or external publication, the student implicitly guarantees that the work contained in the report/paper is original, and any text or content reproduced from other papers is properly credited. While our Program cannot police every single written scholarly paper produced by members of our Department, Journals and online databases today employ very sophisticated programs to verify that the submitted manuscripts abide to common rules of original scholarly publication. Such rules can be found on most Journal websites, and students are particularly encouraged to be familiar with the AIP, IOP, and APS statements on ethics:

https://publishingsupport.iopscience.iop.org/ethical-policy-journals/
https://publishing.aip.org/authors/ethics
https://www.aps.org/policy/statements/02_2.cfm

Students found in violation of these rules will be first warned, and, in case of repeated behavior, dismissed from the Program.

V.7. Academic Honesty and Plagiarism: A primer for students. UMass has well-defined and strict policies about plagiarism and so does the community of scientists. Complying with the rules is clearly very important. Some of the rules are obvious; others are less obvious. Even well-intentioned students can sometimes run into problems. This section is to help you avoid them.
The UMass Academic Honesty Policy is nicely stated with examples online in summary form at: http://www.umass.edu/dean_students/academic_policy and in its entirety here: https://www.umass.edu/honesty/sites/default/files/academic_honesty_policy_rev_sen_doc_no16-038a.pdf. Since plagiarism is the part that is subject to the most uncertainty, the relevant section is quoted here:

“PLAGIARISM is the representation of the words or ideas of another as one’s own work in any academic exercise. This includes:

- failing to properly identify direct quotations by quotation marks or appropriate indentation and formal citation;
- failing to acknowledge and properly cite paraphrasing or summarizing material from another source;
- failing to acknowledge and properly cite information obtained from the Internet or other electronic media as well as other sources;
- submitting term papers written by another, including those obtained from commercial term paper companies or the internet.”

(Quoted directly from the UMass Academic Honesty Policy, posted at https://www.umass.edu/honesty/sites/default/files/academic_honesty_policy_rev_sen_doc_no16-038a.pdf)

To elaborate on a few key points:

1. The rules apply for all documents and presentations, whether published or unpublished.

2. Text or presentations submitted for a course, a prospectus, or thesis must be original writing. The purpose of writing assignments is for the student to struggle with the material him- or herself. This is accomplished by original work. The purpose is not to obtain the best possible document (which might be obtained by copying the work of a renowned expert).

   - You cannot re-submit a paper from a previous course (unless instructor explicitly approves).
   - You cannot copy sections of text (even just phrases) unless there are quotation marks. Instead, one must read and understand the original source and state it in one’s own words.

3. Ideas, equations, and figures that are learned from another source must be explicitly cited. Most of the time, this is obvious. But there are common examples where the rules are not followed:

   - Figures in documents or presentations: there must be an explicit statement of the source (authors and publication information). This applies to quantitative things such as data plots and photos, and also to schematic drawings.
   - Presentations (Powerpoint, etc) must also include citations, preferably on the same slide with the data, equation, figure, etc.

4. In your role as TA, if you see violations of the above please tell the instructor immediately. In your role as student, if you have questions about these rules please ask the instructor or other member of the faculty.