GRADUATE HANDBOOK

Department of Physics & Astronomy
University of Utah

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Welcome from the Director of Graduate Studies

Welcome to our Graduate Program in Physics & Astronomy! If you are like most students in our program, then you are here to prepare the foundation for a rewarding career in Physics, Astronomy, or one of the many diverse fields of industry and finance to which physicists and astronomers contribute. Our graduate degree program will give you the opportunity to achieve this goal. We offer doctoral degrees in Physics, and give the option to follow tracks in Astronomy and Astrophysics, Biophysics, Medical Physics and Physics Education. Although ours is primarily a doctoral program, we offer Master's degrees as well, including a physics-instrumentation degree.

As you work towards your degree, you will choose a research specialization, a choice that can define your career. We offer a wide range of subject areas, including astronomy & astrophysics, biophysics, condensed matter physics, and high-energy particle physics. In addition, some of us work in multidisciplinary specializations, for example, in nanoscience and medical physics. A current list of our specializations, with links to the names faculty working in those areas can be found at


An important part of your graduate experience will be related to how you are financially supported in graduate school. It is typical for your tuition to be covered under the University’s Tuition Benefits Program, which is available to you if you serve as a Teaching Assistant (TA) or work as a Research Assistant (RA). While there are time limitations, you will find that the benefits offered by the University enable you to keep focused on progress towards your degree, meanwhile providing allowance for day-to-day expenses, including health insurance.

This handbook contains information on the graduate experience in the Department of Physics & Astronomy. It covers departmental rules, including the degree requirements — which courses to take, and what exams you’ll need to pass — as well as policy regarding teaching and research assistantships, tuition, and it provides a little bit of information about life as a graduate student. Throughout this document, you will find links to resources, which we compile towards end of this handbook (Section 5). To start off, visit the graduate school at

www.gradschool.utah.edu

which points to the ultimate authority on policy concerning all of the University of Utah's graduate programs. Please peruse it for the wealth it contains. Then, explore this handbook. We hope that it helps make your graduate experience here in our own department rich and rewarding.

— Doug Bergman
Director of Graduate Studies (DoGS)
Department of Physics & Astronomy (P&A)
2 Overview

This document describes the policies and procedures of the Physics & Astronomy Graduate Program. The guidelines described herein are to be followed by all graduate students and faculty in the department.

2.1 People and Committees

The current personnel and composition of the committees below can be found at

www.physics.utah.edu/pdf/department_committees.pdf

**Graduate Coordinator.** The P&A Graduate Coordinator runs the graduate program on a day-to-day basis and helps with the necessary administrative steps that are required of students as they progress toward their degree. The Graduate Coordinator is also a resource for questions about the program.

**Director of Graduate Studies (DoGS).** The P&A Director of Graduate Studies oversees the graduate program with the Graduate Committee (see below). The DoGS also is a resource for questions about the program, our policies or departmental decisions.

**Graduate Committee.** This departmental committee, consisting of P&A faculty and headed by the DoGS, is responsible for overseeing the graduate program. The committee regularly reviews progress of all students in the graduate program, identifying means to support students in reaching academic goals. When the committee identifies a student who is not meeting milestones, the Graduate Committee determines whether progress is sufficient to warrant exceptions, funding, and/or continued registration in the program.

**Assigned Advisory Committee.** Each incoming graduate student is assigned a three-person advisory committee of P&A faculty, to advise on class selection, tuition issues, and finding a research advisor.

**Research Advisor.** The research advisor is the primary research mentor for a student until graduation. Once the research advisor is selected, that person is assigned to the three-person committee and/or the Supervisory Committee.

**Supervisory Committee.** After a doctoral student chooses a research advisor, this advisory committee of five monitors student progress, approves the program of study, and administers exams, including the thesis defense.

**Ombuds Committee.** Designated faculty on this committee serve to help resolve disputes or conflicts that involve graduate students, their advisors, or other faculty. Confidential advice or steps toward conflict resolution are available from any of these committee members.

**Department Chair.** Along with the DoGS, the P&A Chair can help with problems that might arise during students’ graduate experience. The Chair is the person to contact for academic appeals (e.g., grade disputes; see the Student Code), and can connect students with other resources on campus.

**Graduate Student Advisory Committee (GSAC).** The GSAC, composed of current P&A graduate students,

- advises new and continuing graduate students concerning curricula, requirements for degrees, and other aspects of the graduate program;
- makes formal recommendations to the department concerning promotion, tenure, and retention of faculty members;
makes informal recommendations of any kind it feels appropriate concerning the graduate pro-
gram to faculty and leadership of the Department of Physics & Astronomy; and

○ assists the department in communicating and explaining policies and requirements to graduate
students.

More information about GSAC, and its current membership, is at
www.physics.utah.edu/gsac/

2.2 Information for International Students

The primary campus contact for international students is the office of International Student and Scholar Services (ISSS),

internationalcenter.utah.edu/

In particular, the ISSS handles issues related to international student status in the US, and can provide
further information on F-1 and J-1 visas. The Graduate Coordinator serves as a liaison to the ISSS.

Even short-term international travel can pose risks to a student’s ability to re-enter the US and therefore
to continue in the graduate program. The ISSS can help identify potential difficulties and advisability of
travel.

The University provides many other resources to assist international students navigating school and life
in a new country. Of particular note are the Office of the Dean of Students and the University Counseling
Center. Section 5 provides further details.

2.3 Establishing Residency

For students who are US citizens, permanent residents, or people seeking asylum, there are benefits to
establishing residency in the State of Utah. Please see this link for more information:

admissions.utah.edu/apply/residency/faq.php

2.4 Academic Benchmarks and General Requirements

In the following, benchmarks are listed that help to gauge student progress through our graduate program.
Note that some of the requirements below apply to students admitted after July 1, 2018. Students admitted
before that date must fulfill the requirements in place at the time of their admission. (For example, the
Common Exam is not listed below as it is a requirement for all graduate students admitted prior to July
1, 2018 but not thereafter.) Failure to comply with benchmark deadlines may be cause for dismissal from
the program. Here and elsewhere, semester refers to either the Fall or Spring semester, and these two
semesters constitute an academic year. (Summers are typically spent performing thesis research.)

Comprehensive Exams. The Comprehensive Exams consists of the two final exams for two core
classes, PHYS 7110 and 7220; see Section 3.4.1. The Comprehensive Exams are administered by
committee and designed to be completed by the end of the first semester. The deadline for the Com-
prehensive Exam requirement is the end of the first semester of the second year (allowing students
who fail the exam in the first year to retake relevant courses and Comprehensive Exams).
Research Advisor. Students must select a research advisor by the end of their first year and report their selection on the Spring Advising Day form. In most cases, this faculty member will serve as a research mentor throughout a student’s degree program. Changes in advisor are always possible (Section 3.2.2); however, changes may adversely affect timeline requirements, particularly if made at later stages.

The Supervisory Committee. Once an area of specialization and a research advisor have been determined, a student forms a Supervisory Committee; see Section 3.2.1. The Supervisory Committee must be formed by the end of the second year.

The Qualifying Exam. The Qualifying Exam determines whether a student is ready to embark on doctoral research. See Section 3.4.3 for more details. The deadline for taking the Qualifying Exam is the end of the fifth semester. This exam also fulfills the final exam requirement for a M.S. degree (milestone or terminal). Graduate School policy requires that students are enrolled in classes during the semester that the Qualifying Exam is taken.

Program of Study. The Program of Study is a list of courses that a student must take to earn a graduate degree; see Section 3.3.2. The deadline for the Program of Study requirement is the end of the third year. Graduate School policy requires that students are enrolled in classes during the semester that the Program of Study is completed.

M.S. Thesis or Final Exam. In order to obtain a Master’s degree, a Master’s thesis or final exam (in the form of a presentation) is required. Since the Qualifying Exam can satisfy the final exam requirement, Ph.D. students may earn an M.S. degree as well, often referred to as a milestone Master’s Degree.

Ph.D. Thesis Defense. The thesis defense is a public talk followed by a private oral exam. See Section 3.4.4

Submission of thesis to the Graduate School. After the thesis defense, and with appropriate signatures on the Final Reading Form, a student must submit the thesis to the Graduate School’s Thesis Office,

gradschool.utah.edu/thesis/

Students should be aware that there can be a significant delay in the Thesis Office’s processing of submitted theses. Look for opportunities to attend Thesis Office Resource presentations and Thesis Formatting Workshops early in the process. Speaking to a thesis editor about pre-reviewing the first chapter you write can save significant time later.

More complete information, including courses for the Astronomy and Biophysics tracks, is in Section 3.5.

2.5 Important Dates

In addition to the deadlines described in Section 2.4, notable dates for P&A graduate students include

- TA Training. This week-long workshop for new graduate students takes place during the week before the start of the Fall semester. Additional training is sometimes required for international TAs.

- Graduate Student Advising Days. Each Fall and Spring semester, an advising day is held on Reading Day, the day after semester classes end. On this day, all students check in with their respective assigned or supervisory committees, complete a form documenting their progress, and file this form with the Graduate Coordinator; see Section 3.2.3. (Advising Days are not substitutes for regular meetings between a student and advisor to discuss research progress.) University academic schedules, which list Reading Day, are posted here:

registrar.utah.edu/academic-calendars/
3 Graduate Study

In the following, the operation of the graduate program, including financial support, advising, and general degree requirements are described.

3.1 Benefits and Funding for Graduate Study

3.1.1 Assistantships and fellowships

The department offers assistantships that provide an eligible student with a stipend for living expenses. External fellowships are also available. Here is an overview:

**Teaching Assistantships.** TAs work in support of our educational mission. Specific assignments may include leading discussion sections, assisting in classroom labs, grading, or overseeing groups of TAs in large courses.

For international students: The University requires International TAs from non-English speaking countries to pass an English proficiency exam. If a student does not pass it on arrival, then he or she will take a 3 credit hour English class in the first semester or two or until the test is passed. In this transitional period, the student will receive a stipend and will have duties such as grading, which do not require spoken English.

**Research Assistantships.** RAs work on sponsored research projects as determined by the Principal Investigator (PI) on the research grant that provides the support.

**Fellowships.** Fellowship funding is available from the Graduate School, federal agencies and private sponsors; recipients are formally designated as Graduate Assistants (GA) or Graduate Fellows (GF), depending on funding details. Award fellowships carry significant prestige, as well as other benefits not provided to TAs and RAs. See gradschool.utah.edu/graduate-funding-resource-library/financialaid.utah.edu for more information on fellowship opportunities.

To be eligible for any of the assistantships described above, a student must be in good academic standing (maintain a 3.0 cumulative GPA and be on time in compliance with academic benchmarks; see Section 3.6.1). A student’s letter of acceptance to our graduate program from the department will outline how many semesters of support are guaranteed.

3.1.2 TA and RA rights and responsibilities

**RA positions.** RA assignments typically span either academic semesters or full academic years. Duties of an RA assignment are determined by agreement with the PI of the RA funding, typically the research advisor. Ideally, duties are aligned with thesis research.

Students serving as TAs or RAs are expected to work approximately (but no more than) 20 hours a week during the period of appointment. The work loads for positions with lower effort (e.g., “half-RA”) are prorated.

To accommodate periods of intense activity (as well as periods of downtime like vacation during semesters), the 20 hours per week limit may be interpreted, by mutual agreement between the student and PI who is administering the funds for the RA, as an average weekly commitment during each
fiscal quarter. For example, if in a given fiscal quarter, a student wishes to return home for a week, a student and PI may agree that the 20 hour commitment represented by this week-long absence may be distributed over the rest of the quarter. PI’s must make reasonable accommodations in such cases. Students and PI’s should work to clarify expectations of RA responsibilities should they become unclear. If confusion persists, students may also consult with the DoGS, Graduate Coordinator, the Ombuds Committee, and/or the GSAC.

**TA positions.** The Fall and Spring TA appointments are 4.5 months in duration; a full Summer TA appointment is 3 months in duration. The actual academic semesters are shorter; but, in some instances, organizational meetings may take place prior to the start of classes, and there may be grading duties that can be fulfilled only after final exams are over.

Students who are serving as TAs are expected to work approximately (but no more than) 20 hours a week during the period of their appointment. The work load for positions with lower effort (e.g., “half-TA”) is prorated.

During the semester, TA duties take highest priority. No one, including research advisors, can impose requirements that keep TAs from fulfilling TA obligations. If a TA assignment has a scheduled time (e.g., for discussion/lab section, help lab or office hours), it is the TA’s responsibility to arrive on time and remain on site for the full duration of the scheduled time. If there is a grading component, it must be completed in a timely fashion, according to the needs of the course instructor (or TA supervisor) and the reasonable expectation of students. If a TA is unable to fulfill duties for reasons of sickness or emergency (or other excused absences, as per university class attendance policy), he or she must notify the course instructor or TA supervisor as soon as possible.

Documented failure to perform in either TA or RA roles may serve as grounds for termination of the position and funding. TA’s may receive periodic evaluations of performance, will be notified of any deficiencies, and will be monitored for improvement in job fulfillment. The Department follows University Policy 6-309 for the termination of an educational trainee position.

### 3.1.3 Tuition and tuition benefits

Tuition costs for graduate students can be found at

<https://fbs.admin.utah.edu/income/tuition/general-graduate/>.

For most graduate students who are supported either by TAs, RAs, or by fellowships, tuition costs are covered through the university’s Tuition Benefits Program (TBP). There are important eligibility requirements and university rules, some of which are:

- Tuition benefits from the Graduate School are limited to 8 (Fall and Spring) semesters for students who enter the University of Utah graduate program with previous graduate degree (e.g. a M.S. degree);
- Tuition benefits from the Graduate School are limited to 10 semesters for students who enter the University of Utah graduate program with a Bachelor’s degree only;
- Tuition benefits from the Graduate School are limited to 12 semesters for students who enter the University of Utah graduate program with a Bachelor’s degree only and serve as TAs for 4 of the semesters for which they receive tuition benefits.
- In order to be eligible for the tuition benefit through the Graduate School students must be registered for 9–12 credits as an TA, and 9–11 credits as a RA or they must be funded through a fellowship. Other restrictions apply:
  <https://gradschool.utah.edu/tbp/>.
Students entering the University with a graduate degree may submit a written request to the Graduate Committee in order to receive additional tuition assistance beyond their eight semesters of eligibility, up to 10 semesters (or 12 semesters if 4 semesters of TA service have been completed). Students who are in good standing (see Section 3.6.1), and are making documented progress toward completing their degree will receive these additional benefits. In such cases, funding will be awarded to cover the minimum tuition costs required to stay enrolled, and the department will cover 80% of the group health insurance cost typically covered for students who receive tuition benefits from the Graduate School.

If the above options for tuition benefits have been exhausted, the student’s advisor may be able to assist with the minimum tuition costs required to stay enrolled for thesis work. If the advisor is only partially able (or unable) to fund this expense, the student and advisor may request consideration for departmental funding through the Graduate Committee. Such funding is not guaranteed. Requests should be made in writing, submitted jointly by student and advisor, and include a path toward graduation. The Graduate Committee will review such requests to determine merit and eligibility based on academic standing and satisfactory progress toward completion, and will make a recommendation to the Department Chair, who has final budgetary approval.

3.1.4 Differential tuition and course fees

Course fees, including the university’s “differential tuition”, are not covered by the Graduate School’s tuition benefits program. However, if a course is part of a student’s program of study and approved by the research advisor, the student can contact the DoGS requesting that the research advisor or the department cover course-related fees. This request must be made in writing, with documented support from the advisor, prior to the start of the semester for which the fees apply.

3.1.5 Travel funds

A student may apply to the Graduate School for funds to support a professional/scientific conference:

gradschool.utah.edu/diversity/conference-travel/

The department will provide matching funds, if needed, up to the same amount as provided by the Graduate School. Each graduate student is eligible to receive matching departmental travel funds only once. To apply for the department match, a student must complete the Travel Funding Request Form and submit it to the Graduate Coordinator prior to applying to the Graduate School. Applications to the graduate school are done online through the link:

gradschool.utah.edu/current-students/graduate-student-travel-assistance-award/

3.1.6 Health insurance

The University of Utah offers a health-insurance plan for all students, their spouses, and their dependent children under age 26:

www.studenthealth.utah.edu/services/

The Graduate School will cover 80% of the group health insurance cost for students with tuition benefits who are receiving full RA or TA support. For more information, see

gradschool.utah.edu/tbp/insurance-information/
3.1.7 Parental leave

If a supported graduate student or a supported student's spouse or eligible partner (as defined by Human Resources) either

- gives birth to a child and becomes the child's legal guardian, or
- adopts a child under six years of age,

then the graduate student (any gender) may request a parental leave of absence with modified duties for one semester for care-giving leave during a semester within 12 months of the child's arrival. During the leave, the student will receive 4.5 months of support from the department at the standard TA rate.

Care-giving leave means that the student provides the majority of child contact hours during the student's regular academic working hours for a period of at least 15 weeks. Typically, only one semester of leave is granted per child even if there are two graduate students in the Department who could claim parental leave for the child. In most cases, this benefit is granted at most twice for any supported graduate student.

During the leave of absence, the student has modified assigned duties. Typically, there is no teaching requirement during the period of absence. Students may still conduct research and take classes, including reading classes, but are not necessarily expected to work at the same pace for research projects. Students must take at least 3 credits during this semester to maintain their full-time status. Tuition benefits may be used, if the student wishes to continue taking classes, as described in Section 3.1.3. Otherwise a student may take 3 credit-hours without using tuition benefits. The department will cover the tuition cost in this case, as well as the Graduate School's contribution for health insurance premiums for the leave semester. If a student desires, the deadlines to meet various departmental requirements (such as passing the qualifying exam, thesis defense deadline, etc.) can be extended by one semester upon request.

Requests for parental leave should be submitted to the Graduate Program Coordinator and are reviewed by the Chair, Associate Chair, and Director of Graduate Studies. A request for a parental leave of absence with modified duties should normally be made no fewer than three months prior to the expected arrival of the child. It is necessary to make this request in advance so that the particular arrangements of the leave can be planned. The request should specify what duties and/or research the student is planning on performing.

Students who experience a medical condition associated with pregnancy, and need accommodations recommended by their medical provider, should contact the University's Title IX Coordinator, who then works with the student, cognizant faculty, and administration to determine what accommodations are reasonable and effective.

For more complicated situations, the Department tries to proceed in a way similar to the rules for parental leave with modified duties for faculty, as described at regulations.utah.edu/academics/6-315.php

3.1.8 Students voluntarily leaving the program

Students should contact the Graduate Coordinator as early as possible if they are considering leaving the graduate program. The timing of a student's departure from the program impacts whether tuition must be reimbursed and eligibility for a degree. Reimbursement for tuition is delineated in the description of the Tuition Benefit Plan on the Graduate School website (retrieved August 5, 2018):

"IMPORTANT: Students adding and/or dropping courses after the semester's published add/drop deadlines are responsible for any and all charges incurred, including withdrawals. Tuition benefit
will not pay for withdrawn credit hours, and if registration falls below nine credit hours at any time during the semester, a student becomes ineligible for TBP participation and will be billed the full tuition for that semester.”

Students will not earn and receive a Master’s or PhD degree if the Graduate School and Department of Physics and Astronomy requirements have not been met when they leave the graduate program. Students are advised to discuss degree requirements with the Graduate Committee by requesting a special interview before they consider leaving the graduate program. The student should recognize that they would be required to re-apply should they wish to continue in the program and work on another advanced degree.

3.2 Student Advising

Students work initially with an Assigned Advisory Committee before forming a Supervisory Committee. In the following, it is discussed how these two distinct committees are formed and how they operate as well as other advising related questions.

3.2.1 Research advisors and advising committees

**Assigned Advisory Committee.** The Graduate Committee will assign to each incoming graduate student a 3-member advisory committee prior to the beginning of the first semester. Each committee member must be a tenure-line P&A faculty member.

**Research Advisor.** It is the responsibility of each student to identify and select a research advisor who agrees to serve as a mentor on a Masters-level research project or doctoral thesis project. In many cases, the research advisor is also the PI of funds that provide RA support. The research advisor must be chosen by the end of the first year (2nd semester). It is generally expected that this person will serve as research mentor for the remainder of the student’s degree program. However, in early stages (especially the first or second year), there is increased flexibility for changing advisors.

**Supervisory Committee.** Before the end of the second year, each student selects members of a Supervisory Committee that oversees their graduate program, providing approvals and administering exams (e.g., the Qualifying Exam and thesis defense). With the help of the research advisor, the student chooses committee members according to these criteria:

- The committee must have 5 members for a Ph.D., 3 for a M.S. degree, and must be formed by the end of the second year.
- A designated Committee Chair must be a tenure-line P&A faculty member of the Department of Physics and Astronomy. In most cases, the Committee Chair will also be the research advisor. However, it is possible for the research advisor to be from another academic department. (Such cases must be approved by the Graduate Committee and the Dean of the Graduate School.) In these cases, the Committee Chair must still be from the Department of Physics and Astronomy.
- A majority of the committee must be tenure-line P&A faculty.
- One faculty member must be from another department or another university. The latter case requires approval of the Graduate Committee and the Dean of Graduate School.
- The P&A members must span theory and experiment, and different research fields.

To avoid confusion with the last item, here are some examples: If the advisor is a condensed matter theorist, a good choice for a “different research field” would be observational astronomy and vice versa. If the advisor is from an experimental condensed matter physics field, a good choice would be a high-energy theorist or cosmologist.
The student must obtain verbal or written agreement from each member of a proposed Supervisory Committee and then submit the list of committee member names to the Graduate Coordinator to formalize the committee.

### 3.2.2 Changing advisors and committees

Each student must select a research advisor within the first year, based on research specialization and mutual agreement. Until the Supervisory Committee is formed, this arrangement is recorded only at the department level, and may be dissolved unilaterally by either the student or the advisor, provided that there is written notification to the Graduate Coordinator. In this circumstance, it is the student’s responsibility to identify and select another research advisor.

Once chosen, the Supervisory Committee is a formal entity, its membership is recorded by the Graduate School, and the committee’s composition can be changed only by resignation of committee members or upon request by the graduate student, with approval of the majority of the Supervisory Committee and the Supervisory Committee chair. Committee additions must be requested by the graduate student and approved by the advisor. Any change of the Supervisory Committee must also be approved by the DoGS. In cases where the Supervisory Committee is dissolved (for example in the circumstances described below), it is the responsibility of the student to form a new Supervisory Committee within one semester or before the end of the second year, whichever is later.

Occasionally, it may be necessary for a student to change advisors after the Supervisory Committee is formed. If the student and the advisor agree upon such a change, both parties should notify the Graduate Coordinator, who then assists with formalities. The Supervisory Committee is then dissolved, and the student may subsequently form a new committee after identifying a new research advisor.

In absence of an agreement, a student should follow the same procedure by notifying the Graduate Coordinator, who then assists with formalities. However, in addition, the student must notify the advisor in writing, giving a timeframe (15 days or more) for termination and a plan for turning over data, equipment, etc., and (if appropriate) for training other students in the advisor’s research group to take over the research. The advisor is not obligated to pay the student any RA salary if RA responsibilities (as outlined in Section 3.1.2) are no longer being performed.

If conflicts arise between student and advisor arise, resources are available to help resolve the conflict; see Section 5.5. A faculty member can resign from his or her advisorship in cases of when a student violates the Student Code. A faculty member can also resign from his or her advisorship in cases of unsatisfactory performance; however, the following steps are required for this to be allowed:

- The advisor should notify the student in writing (with the DoGS on CC) with examples of unsatisfactory performance, a list of specific goals to help the student improve, and a timeframe of at least 30 days in which to achieve these goals.

- If the student fails to meet these goals, then the advisor should provide the student with written notice to terminate the research relationship (with the DoGS on CC), giving the reasons for termination and the date of termination, which must be at least 15 days after delivery of the notice.

- If the student is funded as an RA by the advisor, then the RA funding may be terminated no earlier than the date specified by the termination notice. Other sources of funding may be available to the student, but must be arranged through the DoGS and the Chair.

- The student is obligated to turn over to the advisor all material (notebooks, equipment, data) related to the advisor’s research.
All correspondence related to Supervisory Committee changes must be copied to the Graduate Coordinator. Students should be aware of potential tuition benefit implications if RA support is terminated, especially if this happened mid-semester. Appeals to decisions made in the course of such processes should be made to the Department Chair. Appeals to the Chair's decisions should be made to the Office of the Associate Dean for Student Affairs in the College of Science for independent review.

3.2.3 Advising committee roles

Course selection. Initially, the Assigned Advisory Committee will help guide a student into the right core courses given the student's background. The Supervisory Committee will determine what electives will be helpful once the area of specialization is decided.

Exams. The Ph.D. Qualifying Exam and the Defense are administered by the Supervisory Committee. For students seeking a Master's degree, either the 3-person Assigned Advisory Committee or (if formed) the Supervisory Committee can administer the Master's Final Examination. See Section 3.4.

Program of Study. The student's Supervisory Committee determines which courses are required for graduation. A meeting devoted specifically to this task is strongly recommended. The student and committee members must carefully formulate this list, which will ultimately constitute the official Program of Study. See Section 3.3.2 for more details.

Advising Checkpoints: Graduate Advising Day.

- Meetings with at least a majority of either the Assigned Advisory Committee or a student's Supervisory Committee, including the research advisor, must take place at least twice per year (once in each of the two academic semesters). Advising Day, held on Reading Day at the end of Fall and Spring Semesters, is set aside for this purpose. Either the student or a committee member may request a longer, follow-up meeting, if time during the Advising Day “checkpoint” meeting is insufficient.

- During a checkpoint meeting, both the student and the research advisor must have the opportunity to meet confidentially with the committee members without the other present. If any conflicts are identified, the committee may refer either party to other resources, including the Ombuds Committee. Any record of information discussed in the absence of either the student or the advisor will be kept confidential unless consent is given otherwise.

- Each meeting must be documented by one of the committee members. For the checkpoint meetings on Advising Day, a form is provided by the Graduate Coordinator, which has an agenda of items to be covered. These forms must be completed, signed and submitted to the Graduate Coordinator. Other forms may be needed to be filled out and returned as well.

- Students in Years 4 and 5 must complete a written Timeline for Graduation Form and give it to the Supervisory Committee members two weeks before the Spring checkpoint meeting. This Timeline to Graduation Form should contain goals and benchmarks, including research objectives and funding prospects. It is to be completed with the advisor.

- Students in Year 6 and beyond must provide a written Time Limit Extension Contract to the Supervisory Committee members two weeks before the Spring checkpoint meeting. This document specifies what benchmarks must be met, along with a time frame, in order for funding to continue. This document must also be filed with the Graduate School at the end of Year 7 for the student to remain registered.

- Graduate Advising Day meetings are not substitutes for regular meetings between a student and advisor (and, as appropriate, Supervisory Committee) to discuss research progress.

- The DoGS reviews all forms from these meetings and presents a summary to the faculty at a meeting immediately following Reading Day. The faculty review all cases wherein students are not in good academic standing or when other issues are known.
Annual Research Advising Sessions.
Starting in the fourth year, the student must meet with the Supervisory Committee for more in-depth assessment of research progress at least once per year, independently of the checkpoint advising sessions. (It is encouraged that this practice begin before the fourth year.) A written statement, approved by the Supervisory Committee must be submitted by the student to the Graduate Committee to record progress and expectations for completion of the research and degree.

3.3 Course Work

3.3.1 Minimum course requirements

Each degree program has a minimum number of credit hours. For the M.S. degree, it is 30 credit hours, of which 20 must be in coursework, and 6 in Special Reading Topics (PHYS 6950) or Thesis Research (PHYS 6970). Note that students pursuing a non-thesis Master’s cannot use Thesis Research credits toward their 30 credit hour requirement.

The University is less strict for the Ph.D.: 14 Thesis Research credit hours (PHYS 7970) are required. However the Department of Physics and Astronomy’s degree programs have additional requirements, see Section 4 for details.

3.3.2 Program of Study requirement

The Program of Study is a formal Graduate School requirement. It is a list of courses required for graduation. It includes the core curriculum, together with additional electives. The Program of Study is determined by the student in consultation with the Supervisory Committee, and must be formally approved by the Supervisory Committee and the DoGS.

The Graduate School’s Program of Study requirement is not complete until the formal approval has been granted and all courses in the Program of Study have been completed with the appropriate grades as described in Section 3.3.5.

The Program of Study requirement must be completed by the end of the third year. Graduate School policy requires that students are enrolled in classes during the semester that the Program of Study is completed.

3.3.3 Transferring course credits

Graduate students may transfer course credits, but are not encouraged to do this except for students who aim to obtain Master’s degrees only. Transfer of up to 6 credit hours is allowed and these credits will count toward the 30 credit hours required for the M.S. degree. For a Ph.D., it may be better to waive course requirements than to transfer credits, because of the Graduate School’s tuition benefit rules.

If a student transfers to The U, (e.g., with a newly-hired advisor), the Graduate Coordinator, the DoGS and the Graduate Committee will help to minimize the impact in terms of course requirements.

3.3.4 Waiving required courses

Successful completing of a course at another university that is equivalent to one of our own may be grounds for waiving a course requirement. Requests for waivers are submitted to the Graduate Committee. Waivers
are not guaranteed.

### 3.3.5 Grading policy

The Department of Physics & Astronomy has adopted the following grading policy: Only a class with a course number above 5000 can count for graduate credit; to get credit for this class, a Master’s student must get a B- or better, and Ph.D. student must earn B or better. A more detailed summary of grades is as follows:

- **“A”** Very good, expected for M.S. and Ph.D.
- **“A-”** Good, acceptable for M.S. and Ph.D.
- **“B+”** Acceptable for M.S. and passable for Ph.D.
- **“B”** Passable at M.S. level, marginally passable at Ph.D. level
- **“B-”** Marginally passable for M.S., unacceptable at Ph.D. level
- **“C”** Unacceptable for graduate work in the Department of Physics & Astronomy

A student who receives an unacceptable grade in a course will have to retake that course if it is a degree requirement. Under special circumstances (depending on the student's in-class performance), and with Supervisory Committee approval, the student may take an equivalent final exam in lieu of retaking a required course. Students are given only two opportunities to pass required courses at the levels indicated above. A second failure of a required course will result in dismissal from the program.

A student who disagrees with a grade may appeal the grade and request to have coursework reevaluated and thus, the grade to be reviewed. The appeal will have to made to the course instructor. If so desired, a student may appeal further, by first consulting with the DoGS, then the Department Chair, and then the College of Science. For more information, see Section IV-B of the Code of Student Rights and Responsibilities:

[regulations.utah.edu/academics/6-400.php](regulations.utah.edu/academics/6-400.php)

### 3.4 Exams

#### 3.4.1 Written Comprehensive Examinations (“The Comprehensive Exam”)

There are two written comprehensive examinations designed to be taken at the end of the first semester. They are the final exams of the Classical Mechanics/E&M I (PHYS 7110) and QM I (PHYS 7220) courses. These final exams are administered by the Comprehensive Exam Committee. The committee includes two instructors for the two courses, as well as three more members. One of the extra three members is the committee chair. The chair oversees the process of putting together the exams.

If test-taking accommodations for the Comprehensive Exam are warranted, the student and instructor will work with the Center for Disabilities Services (CDS) that is found at

[disability.utah.edu](disability.utah.edu)

Access to assistive technology, extended time for tests, or a reduced distraction environment may be available through the CDS.

Students taking the Comprehensive Exam will have three outcomes: Failed, Incomplete, or Passed. (Letter grades are not issued for this exam.) Students who fail a final exam but are otherwise in good
academic standing are required to retake the relevant class (when offered again in the next year) and retake
the relevant exam. An “incomplete” is reserved for cases when a student took the relevant class and did well
on coursework (e.g. homework), but did not pass the corresponding final exam. In such cases, the student
may choose to retake the exam in the next year without retaking the class.

The deadline for completing the Comprehensive Exam requirement is the third semester (that is, the first
semester of the second year). Therefore, a student will have only two opportunities to pass the Comprehen-
sive Exam. Failure to meet this requirement is cause for dismissal from the program.

Students who fail during their second year may remain in the program to complete the Spring semester
of that year. In that last semester, a student may wish to take classes that can offer training for the next step
in their career.

Note: The Graduate School refers to the exam requirement for Master’s degrees as the “comprehensive
exam.” This is not to be confused with the departmental comprehensive exam described above.

3.4.2 Comprehensive Exam preparation and mentoring

In addition to the coursework associated with the Comprehensive Exam, students may prepare by seeking
past exams (as they become available – the earliest that they could be given is Fall 2019).

Furthermore, students who need to retake the exam may request a peer mentor to work one-on-one or
in small groups to provide additional mentoring for exam material. The peer mentor is typically a more senior
graduate student who is designated by the department.

3.4.3 Oral Qualifying Examination

The goal of the Qualifying Exam is to assess a student’s readiness to pursue Ph.D.-level research. Students
may take the Qualifying Exam any time after forming a Supervisory Committee but no later than the end of
their 5th semester. Students are responsible for scheduling the Qualifying Exam. Graduate School policy
requires that students are enrolled in classes during the semester that the Qualifying Exam is taken.

The student should prepare a presentation whose duration is determined in discussions with their Su-
ervisory Committee. The planned duration should not exceed 45 minutes but could be significantly shorter.
The first part of the talk should be a public level talk, giving broad context on the student’s work and its
motivation. The second part of the talk can focus on

1. Scientific results from already existing research;
2. A detailed literature review of papers assigned by their Supervisory Committee;
3. A thesis proposal detailing the physics to be studied and the tools needed to get there;
4. Or a combination of all the items mentioned above.

A graduate student should discuss these options with his or her Supervisory Committee well in advance
of the exam date. During the talk, the student should expect frequent interruptions for clarifications and
additional questions; the exam may take up to two hours. The primary assessment of the exam will be made
based on the student demonstrating broad and deep understanding of the science in their talk. Questions
from the committee will typically draw on knowledge from the student’s coursework, but should be tied to
the topic of the talk; the Qualifying Exam is not meant to be a broad test of general Physics & Astronomy
knowledge.
A written component may also be required as part of the exam. Standards for this component may be determined within individual research groups, or decided by the Supervisory Committees prior to the exam. Examples include a draft of a thesis introduction chapter prior to the Qualifying Exam, or a draft of a submittable paper.

Students may (i) pass, (ii) conditionally pass, or (iii) fail the Qualifying Exam. The committee will decide on additional requirements (in the case of a conditional pass) or whether a second attempt is granted (for failures). The committee has the discretion to refuse to grant a second attempt at passing the Qualifying Exam. (In such case, a student may appeal to the Graduate Committee.) All work associated with conditional passes must be finished by the end of the 6th semester. Second attempts in the case of a failed Qualifying Exam, including additional requirements (in case the second attempt was passed conditionally) must be successfully completed by the end to the 6th semester.

Failure to pass the Qualifying Exam (or, in cases of conditional passes, to complete additional work) by the end of the sixth semester is cause for dismissal from the Ph.D. program.

Note: the Qualifying Exam may also serve as the Graduate School's exam requirement for a non-thesis M.S. degree. If a student is dismissed from the Ph.D. program because the Qualifying Exam has not been completed by the end of the sixth semester, a completion of the exam past the deadline can still serve as fulfillment of the requirement for a non-thesis M.S. degree examination.

3.4.4 Thesis defense

Students pursuing a thesis degree (M.S. or Ph.D.) must pass a final oral examination, the thesis defense, based on a written dissertation. The defense typically consists of a public lecture, followed by a closed-door oral examination by the Supervisory Committee. As a general rule, the thesis defense should be passed by the end of the sixth year.

The Graduate School requires that students submit a final draft of their written dissertation to the chair of the Supervisory Committee at least three weeks in advance of the defense. Students must submit the written dissertation to the remaining committee members and the Graduate Coordinator at least two weeks in advance of the defense. During this time, committee members may provide the student with comments on the dissertation, and the dissertation may be updated as appropriate.

Two weeks in advance of the intended defense (and preferably earlier), the student must begin working with the Graduate Coordinator to schedule and announce the defense.

3.5 Timeline for Graduate Degrees

This section provides an overview of the first three years of graduate study. Based on research interest, there are several recommended tracks. (These tracks are internal designations, and are not transcripted.) Further details are given in Section 4).

3.5.1 Ph.D. timeline and tracks

Table 1 summarizes the contents of this Section for students in Physics, Astronomy, and Biophysics tracks. In it, abbreviations FRO and PDC stand for “Faculty Research Overview” and “Professional Development Course”.

Upon joining the Department. All incoming graduate students are assigned an Assigned Advisory Committee to oversee progress during the Fall and Spring semesters of their first year. (See Section 3.2 for details.)

1st semester. All graduate students take the same three courses during their first semester:

- Classical Mechanics/E&M I (PHYS 7110) (4 credit hours),
- QM I (PHYS 7220) (4 credit hours),
- Faculty Research Overview (FRO) (1 credit hour).

These three courses add up to 9 credit hours. (International students may be required to take an additional 3-credit course in English language skills.) The final exams of Classical Mechanics/E&M I and QM I courses form the Comprehensive Exams; see Section 3.4.1.

2nd semester & 1st summer. In their second semester, students specialize into three separate tracks, each with two or three additional required courses:

- Physics track: all students take QMII (PHYS 7230), E&MII (PHYS 7120), and Stat Mech (PHYS 7310).
- Biophysics track: all students take Stat Mech (PHYS 7310) and Physics in Biology (PHYS 6310).
- Astronomy & Astrophysics track: two required courses, ASTR 6410 (Research Methods), and ASTR 7130 (Radiative Processes) are taken. If only one of these course is offered, students should take at least one other Astronomy elective course along with the offered course at the advice of their advisory committee and/or astro faculty members.

A research advisor must be selected, and summer research should be pursued.

3rd, 4th, and 5th semesters. Students who pass their first year coursework take electives in their second year (3rd and 4th semester). These electives should be approved by their advisory committee prior to taking them. Typically students take at least 3 additional electives.

During the 2nd year, students should continue working on research. Students are encouraged to formulate their PhD Supervisory Committee by their 3rd semester (or earlier), and are required to do so by the end of their 4th semester. Students should begin thinking about preparations for their Ph.D. Qualifying Exam, which can be taken as early as their 4th semester and is required by the end of their 5th semester.

Students should take research credits (at least 6 credits before their 5th semester); this will also enable them to fulfill the M.S. requirements (30 credits total, at least 20 from classes). Terminal masters degrees can be conferred on students who have passed a sufficient number of courses with a B- or higher, or who do not pass their comp exams in two attempts.

By the end of the 6th year. Thesis defense. Defense date past the sixth year are acceptable only with approval of the Supervisory Committee the DoGS, and the graduate school after filing a Time Limit Exemption request.

The timelines for the Department of Physics and Astronomy's Ph.D. programs are given in Table 1.
<table>
<thead>
<tr>
<th>Time</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Phys 7110 - CM/E&amp;M I,</td>
<td>Phys 7230 - QM II,</td>
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<tr>
<td></td>
<td>Phys 7220 - QM I,</td>
<td>Phys 7310 - Stat mech,</td>
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<tr>
<td></td>
<td>FRO,</td>
<td>[Phys 7120 - E&amp;M II],</td>
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<td>[Select Research Advisor]</td>
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<tr>
<td>Year 2</td>
<td>Elective/re-take 7110,</td>
<td>Elective/re-take 7230,</td>
</tr>
<tr>
<td></td>
<td>Elective/re-take 7220,</td>
<td>Elective/re-take 7310,</td>
</tr>
<tr>
<td></td>
<td>PDC,</td>
<td>[Supervisory Comm. formed],</td>
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<td></td>
<td>[Research]</td>
<td>[Research]</td>
</tr>
<tr>
<td>Year 3</td>
<td>[The Qualifying Exam],</td>
<td>[Additional Qualifying Exam Requirements],</td>
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<tr>
<td></td>
<td>[Research]</td>
<td>[Research]</td>
</tr>
<tr>
<td>Years 4,5,6</td>
<td>[Research]</td>
<td>[Y6: Thesis defense; earlier is fine]</td>
</tr>
</tbody>
</table>

**Astronomy Track**

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<thead>
<tr>
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</thead>
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<tr>
<td>Year 1</td>
<td>Phys 7110 - CM/E&amp;M I,</td>
<td>Take two of:</td>
</tr>
<tr>
<td></td>
<td>Phys 7220 - QM I,</td>
<td>Phys 7130 - Radiative Processes,</td>
</tr>
<tr>
<td></td>
<td>FRO,</td>
<td>Astr 6410 - Research Methods,</td>
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<td>[Summer research]</td>
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<tr>
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</tbody>
</table>

**Biophysics Track**

<table>
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<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Phys 7110 - CM/E&amp;M I,</td>
<td>Phys 6310 - Physics in Biology,</td>
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<tr>
<td></td>
<td>Phys 7220 - QM I,</td>
<td>Phys 7310 - Stat mech,</td>
</tr>
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<td></td>
<td>FRO,</td>
<td>[Advisory comm. updated],</td>
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<tr>
<td></td>
<td>[Comprehensive Exam taken]</td>
<td>[Summer research]</td>
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<tr>
<td></td>
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<td>[Select Research Advisor]</td>
</tr>
<tr>
<td>Year 2</td>
<td>Elective/re-take 7110,</td>
<td>Elective/re-take 6310,</td>
</tr>
<tr>
<td></td>
<td>Elective/re-take 7220,</td>
<td>Elective/re-take 7310,</td>
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<tr>
<td></td>
<td>PDC,</td>
<td>[Supervisory Comm. formed],</td>
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<td></td>
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<td>[Research]</td>
</tr>
<tr>
<td>Years 4,5,6</td>
<td>[Research]</td>
<td>[Y6: Thesis defense; earlier is fine]</td>
</tr>
</tbody>
</table>
3.5.2 M.S. timeline

All M.S. programs follow tracks similar to the first two years of the Ph.D. program. Course selections may differ, depending on the program (e.g., M.S. Physics or the Master’s in Instrumentation Physics) and the directives of the student’s supervisory committee. The Ph.D. Qualifying Exam may serve as the student’s M.S. Final Examination. Students receiving a Master’s degree are expected to complete all degree requirements by the end of the third academic year, although programs are set up so that students can complete these requirements within two years. Requests for an extension beyond the third year must be made to the Graduate Committee.

3.6 Evaluation of Student Progress

3.6.1 Good academic standing

Students are expected to make steady progress towards their degree, as indicated by these benchmarks:

- Maintain a cumulative GPA of 3.0 or above.
- Pass all required classes with a grade of at least B-.
- Satisfy Written Comprehensive Exam requirements by the end of the third semester.
- Form the Supervisory Committee by the end of the second year (earlier is better).
- Pass the Oral Qualifying Exam by the end of the Fall semester of the third year.
- Complete required coursework for the Ph.D. (and file a Program of Study) by the end of the third year.
- Achieve satisfactory advances in research, as judged by the research advisor and the Supervisory Committee.
- Timely Fulfillment of other obligations (e.g., the submission of Graduation Plan and Time Limit Extension contract) as required by the department and the Graduate School.

Satisfying these benchmarks defines a student in good standing. Students who fall out of good academic standing typically have one semester to remediate before being dismissed from the graduate program.

3.6.2 Academic probation

The Graduate School requires that students maintain a 3.0 cumulative GPA to be eligible for tuition benefits. Failure to maintain this cumulative GPA will result in a student falling out of good academic standing in the department and in formally being placed on Academic Probation by the Graduate School. Neither the Graduate School nor the department will offer tuition benefits to students who are on Academic Probation, nor will the cost of classes be covered that may be retaken.

3.6.3 Dismissal

Dismissal from a program of the Department of Physics and Astronomy may result from a serious violation of the Student Code and/or failure to maintain good academic standing with no feasible plan to return to that status. Failing to maintain a 3.0 GPA, failing to pass the Comprehensive Exam within the first two academic years, or failing to pass the Qualifying Exam within the first three years are examples.
Students will be informed in writing by the Graduate Committee of academic deficiencies that cause the student to fall out of good academic standing and will be given an opportunity during the following semester to remedy their academic deficiencies and achieve the required benchmark. The Graduate Committee will provide written notification to the student that they have failed to remedy the deficiencies and will be dismissed from the program at the end of the academic year in which the failure occurs. If the academic deficiency is a second failure of the Comprehensive Exam or the Qualifying Exam (both of which are typically given at the end of the fall semester), students who are otherwise in good academic standing are given the option to finish the requirements for a M.S. degree and/or take courses that may help them for their career beyond graduate school in the spring semester. Eligibility for TA or RA support during this time is determined by the Graduate Committee in consultation with the research advisor (if applicable). Dismissal from the program shall result in termination of graduate student funding.

3.6.4 Appeals

Students who fail to meet a required benchmark may provide a written appeal to the Graduate Committee for an extension or waiver of a specific requirement. An appeal must include a plan to satisfy remaining requirements, but this alone is not sufficient to warrant extensions or waivers. It is within the discretion of the Graduate Committee whether or not to grant extensions or waivers and will be based upon the Committee's academic judgement concerning the student's ability to ultimately succeed in the program. In addition, there are University Policies governing appeals; see Section 6.400.IV.B in the Student Code.
4 Degree Requirements

4.1 Overview of graduate degrees and research areas

In this section the degree offerings are discussed, starting with the traditional physics Ph.D. and including degrees with emphasis in specialized areas.

4.1.1 Degrees offered by the Department of Physics & Astronomy

The department offers the following degrees:

- **Ph.D. Physics**
  - Physics (standard) track
  - Astronomy & Astrophysics track
  - Biophysics track
  - Medical Physics track
  - Physics Education track

- **M.S. Physics**
  - Physics (standard) track
  - Instrumentation Physics (MSI Program)
  - Computational Physics

The tracks listed above indicate specializations with unique departmental requirements, although the tracks all lead to either the M.S. or Ph.D. in Physics.

4.1.2 Related degrees

- Professional Master of Science and Technology (PMST). A professional, non-thesis, interdisciplinary program that fuses graduate studies in science and mathematics with skills from other professional domains, such as business, communication, and management. PMST Program: web.utah.edu/pmst.

- Master of Science for Secondary School Teachers (MSSST). This degree is for professional development for teachers to develop content knowledge and new pedagogical techniques. MSSST Program: csme.utah.edu/mssst/.

4.1.3 Graduate School requirements

Students pursuing a Ph.D. degree in Physics must satisfy Graduate School requirements, as well as the department-specific requirements given below. For the list of the Graduate School requirements, visit gradschool.utah.edu/graduate-catalog/degree-requirements/

Departmental requirements are listed in Sections 4.2 and 4.3, 4.4, 4.5 and 4.6.

*Note:* To pass a course for credit toward a Ph.D. in P&A requires a grade of B or better. In addition, to receive graduate credit, the course number must be 5000 or above.
4.2 Ph.D. in Physics (Standard Track)

Students pursuing a Ph.D. degree working in the fields of Condensed Matter Theory, Condensed Matter Experiment, Particle Physics, and Cosmic Ray Research should seek entrance into, and then complete our standard Ph.D. program.

4.2.1 Course and exam requirements

Students pursuing the standard Ph.D. degree should follow the Physics track in the first year at the department, and take the associated required coursework:

- PHYS 7110 Classical Mechanics/E&M I
- ASTR 7120 E&M II
- PHYS 7220 Quantum Mechanics I
- PHYS 7230 Quantum Mechanics II
- ASTR 7310 Statistical Mechanics

(See also Section 3.5.1.) In addition, the Faculty Research Opportunity (FRO) class and Professional Development Class (PDC) are required, as well as 14 credit-hours of PHYS 7970, Thesis Research: Ph.D. The exam requirements include the Comprehensive Exams, The Qualifying Exam, and the Thesis Defense. See Section 3.4 for full details.

4.2.2 Suggested electives

The suggested sequences of elective courses for each research direction in the standard emphasis are listed here. At least three electives are recommended for each research direction.

- **Condensed matter theory**
  - PHYS 5510 Intro to Solid State Physics
  - PHYS 7640 Quantum field theory I
  - PHYS 7650 Quantum field theory II
  - PHYS 7740 Mathematical Methods of Physics
  - PHYS 7550 Group theory

- **Condensed Matter Experiment**
  - PHYS 5510 Intro to Solid State Physics
  - PHYS 5520 Electronic Processes in Semiconductors
  - PHYS 6510 Physics of Semiconductors
  - PHYS 6770 Optical Measurement Techniques and Instrumentation
  - PHYS 6775 Optical Measurement Techniques and Instrumentation Laboratory (this course is a substitute of PHYS 6719 (graduate lab) and requires PHYS 6670 to be taken at the same time)
  - PHYS 7740 Mathematical Methods of Physics
  - Also: Group Theory (CHEM or PHYS), Micromachining (ENG).
  - While not elective courses

- **Particle physics**
  - ASTR 5580 Cosmology
PHYS 7640 Quantum field theory I
PHYS 7650 Quantum field theory II
PHYS 7720 General Relativity and Relativistic Astrophysics
PHYS 7740 Mathematical Methods of Physics
PHYS 7550 Group theory

- Cosmic Ray Research
  ASTR 5015 Observational Methods and Data Analysis
  ASTR 5560 Stars and Stellar Populations
  ASTR 5570 Galaxies
  ASTR 5580 Cosmology
  ASTR 5590 Stellar Astrophysics
  PHYS 7310 Statistical Mechanics
  PHYS 7640 Quantum Field Theory I (and PHYS 7650 QFT II)
  PHYS 7720 General Relativity and Relativistic Astrophysics
  PHYS 7730 Statistical and Computation Methods in Physics & Astronomy

4.3 Ph.D. in Physics: Astronomy and Astrophysics Track

The University of Utah’s Department of Physics transitioned into the Department of Physics & Astronomy in 2009 and since then, the Astronomy section has grown into a widely recognized program. Students may specialize in the fields of Theoretical Astrophysics, Relativity & Cosmology, or Observation Astronomy.

4.3.1 Course and exam requirements

Students pursuing a Ph.D. degree in the astro track should take the following courses:

- PHYS 7110 Classical Mechanics/E&M I
- PHYS 7220 Quantum Mechanics I
- ASTR 6410 Research Methods in Astronomy
- ASTR 7130 Radiative Processes

as well as the FRO and PDC classes, as in the timeline in Section 3.5.1. As per university rules, 14 credit-hours of PHYS 7970 (Thesis Research: Ph.D.), are required, too. The exam requirements are identical to other tracks, and are given in Section 3.4.

4.3.2 Suggested electives

Students must also take three of the following electives:

- ASTR 5560 Stars and Stellar Populations
- ASTR 5570 Galaxies
- ASTR 5580 Cosmology
- ASTR 5590 Stellar Astrophysics
- PHYS 7310 Statistical Mechanics
- PHYS 7640 Quantum Field Theory I (or PHYS 7650 QFT II)
- PHYS 7720 General Relativity and Relativistic Astrophysics
Finally, 14 credit-hours of PHYS 7970, Thesis Research: Ph.D., are required.

Note: To pass a course for credit toward a Ph.D. in P&A requires a grade of B or better. In addition, to receive graduate credit, the course number must be 5000 or above.

The exam requirements are identical to other tracks, and are given in Section 3.4.

4.4 Ph.D. in Physics: Biophysics Track

Students interested in a doctoral degree in the field of Biophysics will have opportunities in research, supported by elective courses within the department as well as offerings in Biology.

4.4.1 Course and exam requirements

The Biophysics track Ph.D. degree requires the following core courses:

PHYS 7110 Classical Mechanics/E&M I  
PHYS 7220 Quantum Mechanics I  
PHYS 6310 Physics in Biology  
PHYS 7310 Statistical Mechanics

and as well as the FRO and PDC classes (see the timeline in Section 3.5.1). As per university rules, 14 credit-hours of PHYS 7970 (Thesis Research: Ph.D.), are required, too. The exam requirements are identical to other tracks, and are given in Section 3.4.

4.4.2 Suggested electives

PHYS 6210 Optics in Biology  
PHYS 6230 Molecular Motors  
PHYS 7730 Statistical and Computation Methods in Physics & Astronomy  
CHEM 6740 Bioanalytical Chemistry  
PH TX 7500 Macromolecular Therapeutics & Drug Delivery  
PATH 6410 Molecular Virology  
MBIOL 6480 Cell Biology I  
PATH 7310 Host Pathogen Interactions  
ONCSC 6500 Clinical & Molecular Cancer Biology

4.5 Ph.D. in Physics: Medical Physics Track

Medical Physics is the application of physics to medical imaging and radiation therapy. This track may involve working with a faculty member outside of Physics and Astronomy, such as the Department of Radiology’s Advanced Imaging division (UCAIR), or the Scientific Computing and Imaging (SCI) Institute in the School of Computing.
4.5.1 Course and exam requirements

The core courses and exams are the same as for the standard physics track.

4.5.2 Suggested electives

Possible electives depend on the particular course of study and are therefore discussed with the Supervisory Committee and the research advisor.

4.6 Ph.D. in Physics: Physics Education Track

The Department of Physics & Astronomy is involved in research and development activities in Physics Education. A Ph.D. candidate interested in this area may obtain a dedicated Ph.D. in Physics: Physics Education degree.

4.6.1 Course and exam requirements

A student in Physics Education has the same requirements as in the standard Physics track, but may take electives that come from other Departments, such as Education and Philosophy. Consult with your advisor and Supervisory Committee.

4.7 M.S. in Physics

The Master’s Degree in Physics is demonstrates that a student has a solid foundation in graduate physics and has the ability to do research in physics or astronomy. Students work on a research project, and have the option to write a Master’s Thesis describing the results.

4.7.1 Course and exam requirements

A student seeking a Master’s in Physics must choose a program track (Standard Physics, Astronomy & Astrophysics, Biophysics) and fulfill the course requirements of that track. Beyond the core course requirement, a total of 30 credit-hours must be earned, each with a grade of “B-” or better. At least 20 credit-hours must come from classes, and (if a thesis-based M.S. degree is sought) at least 6 credit-hours of Thesis Research (PHYS 6970 or PHYS 7970).

Elective courses must be in physics or a related discipline that may further a physics-related career, such as computational science, statistics or education courses. The courses must be approved by a Master’s Supervisory Committee of 3 P&A faculty.

A Master’s Final Examination or Thesis Defense are required as well. In cases where students opt not to write a thesis, they must work on and present a research project in an exam format equivalent to the Qualifying Exam (see Section 3.4.3).
4.8 M.S. in Instrumentation Physics

The Master of Science in Instrumentation (MSI) program is designed to qualify those with training in various scientific and engineering fields to understand, work with, and develop modern numerical methods, electronics, measurement system characterization, computer data acquisition/control, and the physical principles of the operation of various measurement transducers and sensors. The candidates are required to take part in an instrumentation project, which can be in a wide variety of research and industrial test areas. This program is a non-thesis degree track.

4.8.1 Course and exam requirements

A student must earn a total of 30 credit-hours. A grade of “B-” is required for credit toward the degree. At least 20 credit-hours must come from classes, including these required courses:

- PHYS 6610 Electronics for Scientific Instrumentation 1
- PHYS 6620 Data Acquisition for Scientific Instrumentation
- PHYS 6750 Applied Modern Optics I & II
- PHYS 6770 Optical Measurement Techniques & Instrumentation
- PHYS 6730 Computational Physics

Electives are chosen according to research area, and must be approved by a 3-person Master’s Supervisory Committee, which includes a research advisor.

A Master’s Final Examination is required, wherein a student present a research project in an exam format equivalent to the Qualifying Exam (see Section 3.4.3).

4.9 M.S. in Computational Physics

This program is intended to equip students with modern computational skills for use in solving problems in the physical sciences. It is typically a non-thesis degree program.

4.9.1 Course and exam requirements

A student must earn a total of 30 credit-hours. A grade of “B-” is required for credit toward the degree. At least 20 credit-hours must come from classes. The student must take the core courses from any of the Ph.D. tracks, and PHYS 6720, Introduction to Computers in Physics.

Electives may be taken with the approval of your 3-person Master’s Supervisory Committee, which includes the research advisor.

As with our other non-thesis programs, a Master’s Final Examination is required: A student presents a research project in an exam format equivalent to the Qualifying Exam (see Section 3.4.3).
5 Resources

In the following, general resources are described that are available for graduate students at the University of Utah.

5.1 List of Key University Resources

Emergency. University Police: https://dps.utah.edu
Phone: 911 or 801-585-COPS / 801-585-2677 Call even if you feel unsafe at all!

Crisis (24/7). UNI: https://healthcare.utah.edu/uni/programs/crisis-diversion.php
Phone: 801-587-3000 for crisis intervention, emotional support, and mental health needs, any time.

Suicide prevention in Utah.: http://www.suicide.org/hotlines/utah-suicide-hotlines.html

Crisis Prevention. SafeUT smartphone app: uofuhealth.org/safeut
Free 24/7 access to counselors for crisis prevention and emotional support

Counseling. University Counseling Center: https://counselingcenter.utah.edu
Location: Rm 426, Student Services Building (SSB)
Phone: 801-581-6826

Sexual assault victim advocacy. Wellness Center: https://advocate.wellness.utah.edu
Location: Rm 328, Student Services Building (SSB)
Phone: 801-581-7779

Medical help. Student Health Center: https://studenthealth.utah.edu/services/
Location: Madsen Health Center, 555 Foothill Drive
Phone: 801-581-6431

Wellness. Center for Student Wellness: https://wellness.utah.edu
Location: Rm 2100, Eccles Student Life Center; There is a massage chair for you to use!

Support for women students & scholars.
Women's Resource Center: https://womenscenter.utah.edu
Location: Rm 411, Olpin Union

Disability and equal access. Center for Disability Services: https://disability.utah.edu

Student support. The Office of the Dean of Students: https://deanofstudents.utah.edu
Location: Rm 270, Olpin Union, A great resource for all students.

For International students. ISSS: https://internationalcenter.utah.edu
Location: Rm 410, Olpin Union

5.2 Safety and Wellness

Your safety is our top priority. In an emergency, dial 911 or seek a nearby emergency phone (throughout campus). Report any crimes or suspicious people to 801-585-COPS; this number will get you to a dispatch officer at the University of Utah Department of Public Safety (DPS; dps.utah.edu). If, at any time, you would like to be escorted by a security officer to or from areas on campus, DPS will help — just give a call.

Your well-being is key to your personal safety. If you are in crisis, call 801-587-3000; help is close. The university has other excellent resources to promote emotional and physical wellness, including the Counseling Center (https://counselingcenter.utah.edu), the Wellness Center (https://wellness.utah.edu),
and the Women’s Resource Center (https://womenscenter.utah.edu). Counselors and advocates in these centers can help guide you to other resources to address a range of issues, including substance abuse and addiction.

Attending graduate school can be challenging. Talk with a counselor or a wellness advocate: No cry for help shall go unheard. Use all available resources to make your grad experience a great one. Attending graduate school can also be a wonderful and most rewarding experience of your life.

5.3 International Students

**Immigration and visa issues.** International students have a unique set of obligations that they have to follow in order to be allowed to stay in the U.S. The University’s International Student and Scholar Services (ISSS, also known as the International Center; https://isss.utah.edu) is the key resource. If you are an international student, please check in with ISSS if you have any questions at all related to your visa and immigration status. Staying in compliance with your visa is essential. ISSS personnel are experts, ready to help. The department is on your side, too. If you need anything visa-related, like a letter of support or getting your advisor’s signature or authorization on a visa application, then contact ISSS and the department Chair as soon as possible.

ISSS is a good resource for helping you make decisions about travel to and from the U.S. In the past, our students have had trouble because they traveled to their home country in the middle of a semester and were unable to return when expected. The ISSS can give you guidance on how to make course enrollment decisions related to the compliance with immigration requirements or when it comes to leaves-of-absence.

**International communities on campus.** If you are an international student, you are not alone in this situation at the University of Utah! There are organizations like the Chinese Students and Scholars Association (cssauu.utah.edu) that provide a network of support and social activities. The Department of Physics and Astronomy alone has had international students and scholars from countries of all continents (except Antarctica, although P&A students have conducted research there).

5.4 Disability and Equal Access

The University provides accommodations to enhance your educational development if you are a student with disabilities. The range of services is broad, and the Center for Disability Services (CDS; disability.utah.edu) will help you to obtain equal access to programs and facilities as well as accommodations for test taking. Please contact the CDS directly for more information.

5.5 Conflict Resolution

The Department of Physics and Astronomy accommodates a professional community. Respect and support for one another are needed and expected, in order to meet the challenges of coursework, research, and instruction. In the following, resources are discussed that aim to help and protect students who experience misconduct. These resources aim to nurture respect and prevent conflict.

**Student Rights and Responsibilities.** The University of Utah’s policies regarding your conduct as a graduate student are defined by the University of Utah’s

Student Code: www.regulations.utah.edu/academics/6-400.html
The Department of Physics and Astronomy is a place of learning and others' pursuit of knowledge shall not be impeded. Failure to uphold the Student Code may result in dismissal from the university. The nature of any conflict may determine any response by the University and the Department.

**Physical threat.** First and foremost, be safe. If there is any physical threat to you, try to move yourself out of the situation and contact 911 or Campus Police (801-585-COPS).

**Sexual Harassment or discrimination.** In cases of sexual harassment or discrimination of any sort, contact the DoGS, the Chair, or the Office of the Dean of Students (ODOS; deansoftern.utah.edu). The Office of Equal Opportunity (OEO; oeo.utah.edu) may also help.

**Interpersonal conflict.** If a conflict arises between two or more people, it may help to start with an open discussion to resolve the conflict. If that plan is not feasible, the DoGS, GSAC, Ombuds Committee members or the department Chair are the next best resources to try and resolve issues. The Graduate School or the Office of the Dean of Students may provide another level of support for conflict resolution.

**Academic disputes and appeals.** For academic disputes such as contested grades, cheating accusations or publication authorship, for example, the DoGS or Chair can help. Grade-related academic appeals that cannot be resolved between a student and an instructor should be made to the Chair, then the Associate Dean of Student Affairs in the College of Science, following well-established university policy (Section IV-B of the Student Code).

Retaliation against individuals for engaging in protected activities, such as filing a discrimination complaint or participating in a discrimination complaint process, is prohibited under University Policy; see, for example, Policy 1-012. The resources listed above can assist in navigating the specifics of this policy.

### 5.6 Academic Resources

To help with the academic component of a graduate student's experience, the Department of Physics and Astronomy, the College of Science and the university provide a number of resources:

**Library resources.** There are excellent libraries on Campus which provide Graduate Students with access to databases and help for literature searches, among many other things. Most significantly, Marriott Library: lib.utah.edu.

**Computing.** The department has linux and PC computer servers for academic use. For more intensive computational work, students may be able to get an account with our Center for High-Performance Computing: CHPC/high-end computing: www.chpc.utah.edu.

**Travel.** There are resources available for Graduate Students for travel to professional conferences. Organizations like the American Physical Society and the American Astronomical Society have travel awards. The Graduate School can also provide funds; follow this link for more info.

**TA/Instructor resources.** The Department of Physics and Astronomy offers training to incoming graduate students on their arrival prior to each Fall semester. Also, the Center for Teaching and Learning Excellence (CTLE; ctle.utah.edu) provides annual training seminar for grad students, postdocs and faculty:

CTLE's Annual Training Seminar: ctle.utah.edu/ats/


**Dissertation bootcamp.** To get your thesis writing underway, or just to know that you are in good company as a thesis writer and want to connect with others in the same situation:

5.7 Career Services

The University provides excellent resources for students seeking post-graduation employment:

Career & Professional Development Center: careers.utah.edu

5.8 Parenting and Graduate School

If graduate students are parents or about to become parents, there are resources and benefits (see Section 3.1.7) in place. The department provides parental leave for funded grad students. The Department of Physics and Astronomy has two dedicated rooms for privacy to support student and faculty mothers who are breast-feeding infants. Please ask at the department main office for more information. The university also has resources to help with childcare (childcare.utah.edu).

5.9 Beyond the Department

The following list contains suggestions for activities, some with a professional benefit, and others just for fun:

- Join the American Physical Society or the American Astronomical Society as a student.
- Participate in a Graduate Student Advisory Committee (GSAC) activity
- Check out a play at the Pioneer Memorial Theater or see an event at Kingsbury Hall (tickets are discounted for students).
- Go to a Frontiers of Science lecture, sponsored by the College of Science.
- Go to the gym, hike or ski.
- Volunteer to judge at a grade school science fair.
- Do a gallery stroll downtown.
- Visit any of the spectacular National Parks or State Parks of Utah (https://www.visitutah.com/).

And finally, the university has lots of other things going on:

U of U events calendar: www.utah.edu/events/