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1. INTRODUCTION

Welcome to the Graduate Program in Physics and Astronomy! If you are like most students in our program, then you are undertaking graduate study to accomplish several goals: first, to develop a broad and sophisticated knowledge of the field as a whole; second, to acquire a deep and thorough understanding of some specialized field; to contribute to the body of knowledge of that field through your own research; and finally, 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 contribute.

We offer a number of options to achieve these goals. Most of our students seek a Ph.D. in Physics, but we also confer Ph.D.s in Chemical Physics and Physics with formal emphasis in Medical Physics or Physics Education. We offer several types of Master’s degrees as well: the M.S. in Instrumentation Physics (MSI), the M.S. in Computational Physics, and a Master’s degree in Physics. We admit students into our program as Master’s degree candidates only for the first two M.S. degrees. The role of the Master’s in Physics is to provide either a milestone or an alternative to the Ph.D. for predoctoral students.

Your choice of research specialization can define your career. We offer a wide range of subject areas including Astronomy & Astrophysics, Atomic physics, Biophysics, Chemical Physics, Condensed Matter, and High-energy/Particle Physics. In addition some of us work in multidisciplinary specializations, for example, nanoscience and medical physics. A current list of our specializations, with links to the names faculty working in those areas is here: [http://www.physics.utah.edu/research.html](http://www.physics.utah.edu/research.html)

A big part of your graduate experience will be related to how you financially handle being in grad 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) for your thesis advisor. While there are time limitations, you will find that the benefits offered by the University enable you to keep focused on progress toward 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 and Astronomy. We cover the rules—namely degree requirements such as which courses to take, and what exams you’ll need to pass—as well as policy regarding teaching assistantships (TA), the all-important rules of tuition benefits, and even a little about life as a graduate student. Along the way, you will find links to resources, which we compile toward end of this handbook (Section 4). We start you off with this link:

[http://www.gradschool.utah.edu](http://www.gradschool.utah.edu)

It points to the Graduate School, 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!

---

Director of Graduate Studies (DoGS)

Department of Physics and Astronomy
2. GRADUATE STUDY

There are certain common points in the administrative and academic flow of our graduate degree offerings and we describe them here. The goal is to give you a sense of what your obligations are, and to provide tips on how to most efficiently complete your degree program.

2.1. OVERVIEW OF GRADUATE DEGREES AND RESEARCH AREAS

Here we summarize the various degrees we offer and the areas of specialization in our Department. Section 3 has details about each degree offering.

<table>
<thead>
<tr>
<th>Degree offerings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ph.D. Physics</strong>. This degree is the choice for most of our students, with specializations from nanoscience to cosmology. Graduates have gone into positions in academia, industry and finance.</td>
<td><strong>Ph.D. Chemical Physics.</strong> This interdisciplinary degree enables students to work in areas of overlap between physics and chemistry including materials science and molecular physics.</td>
</tr>
<tr>
<td><strong>Ph.D. Physics: Astronomy &amp; Astrophysics.</strong> This doctoral program is tuned to astronomy, and spans theory and observations of stars, galaxies and the large-scale structure of the Universe.</td>
<td><strong>M.S. Computational Physics.</strong> Students learn cutting-edge numerical techniques in physics and astrophysics, with access to the University's world-class high-performance computers.</td>
</tr>
<tr>
<td><strong>Ph.D. Physics: Education.</strong> Students seeking this degree can engage in Physics Education Research toward expanding the innovative teaching strategies used in the Department.</td>
<td><strong>M.S. Instrumentation Physics.</strong> Students take part in the design, characterization and production of instruments, electronics, sensors, or algorithms for research and industrial application.</td>
</tr>
<tr>
<td><strong>Ph.D. Medical Physics.</strong> Students in medical physics work with our own faculty or with outside researchers. Elective coursework is geared to medicine (e.g., physiology, radiology).</td>
<td><strong>M.S. Physics.</strong> The Master’s degree is for students on their way to obtaining a Ph.D. or those who leave the Ph.D. program. Research topics can be drawn from a wide range of specializations.</td>
</tr>
</tbody>
</table>
Research areas (including facilities and collaborations)

**Astronomy.** Optical, IR and γ-ray observation, cosmochemistry, stellar and galactic astronomy, cosmology (Eccles Observatory, SDSS III, BOSS).

**Astrophysics Theory.** Cosmology, dark matter, galaxy evolution, large-scale structure, planetary systems, relativistic astrophysics (HEA Institute).

**Atomic physics.** Hyperpolarized gases, Atomic forces Microscopy, surface physics (D. M. Grant NMR Center [“Gauss House”]).

**Biophysics.** Near-field fluorescence microscopy, molecular motors, enveloped virus budding, MRI and (U---STAR).

**Cosmic Rays.** Ultra-high energy cosmic ray, detection design and experiment (High Resolution Fly’s Eye, Telescope Array).

**Condensed Matter Experiment.** Quantum dots, spintronics, organic semiconductors, photonics, and physics of extreme conditions.

**Condensed Matter Theory.** Disordered systems, graphene, nanotubes, magnetism, spin polarized transport, and superconductivity.

**Education.** Physics education with specialty in medical physics, computer-aided instruction (Center for Math & Science Education).

**High Energy Physics Theory.** Lattice QCD, LHC phenomenology, dark matter, string theory (MILC, Center for High Performance Computing).

**Medical Physics.** MRI, hyperpolarized gas imaging, Raman spectroscopy, retinal imaging (UCAIR/Radiology).

**Nanoscience.** Nanoscale optics and imaging, atomic force microscopy, photon trapping, single molecule experiments (Utah Nanoscience Inst.).

**Research Centers and Institutes.** Materials Research Science & Engineering Center (MRSEC), Center for Acoustic Cooling, Dixon Laser Inst.


2.2. OVERVIEW OF FUNDING FOR GRADUATE STUDY

The vast majority of our students are paid to go to school, in exchange for teaching or working on sponsored research. This section describes how this funding process works. It is mostly relevant for students in the doctoral program, but does provide some options for Master’s students.

2.2.1 Assistantships and Tuition Benefits

**TA’s and RA’s.** Incoming Ph.D. students are usually offered a teaching assistantship, which pays a stipend to cover living expenses. M.S./M.S.I. students are not automatically given assistantships, but may receive them on a case-by-case basis. Your acceptance letter will specify whether you receive an assistantship, how much it is, and for how many years it is guaranteed. Typically you will be a teaching assistant (TA) for your first two years. As a TA, you will help an instructor teach a course, which may entail duties such as grading and leading discussion sections (see Section 4 for details). Each TA assignment lasts a semester; students generally TA during Fall and Spring semesters. (See Section 4.)

Usually within two years, you will begin your dissertation work with a research advisor and become a research assistant (RA). The RA stipend is similar to that of a TA, but the duties are solely focused research under that advisor’s guidance. If your thesis advisor does not have funding, you may continue to work as a TA (depending on Departmental needs), or as an RA in a group or lab unrelated to your dissertation research.
Tuition benefits. The University charges tuition for attending graduate school. However its Tuition Benefits Program (TBP) helps most students complete their degrees without incurring any tuition costs. There are limitations, as discussed in the next section. Some are straightforward (e.g., keep a 3.0 GPA) some are not. They are all worth knowing:

http://www.gradschool.utah.edu/tbp

International students and “transitional TA’s”: The University requires International TA’s 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 is not officially a TA; instead, the student is a “transitional TA” (our wording!) and will still receive a stipend like a TA’s, and will have duties such as grading, which do not require spoken English.

2.2.2 Health Insurance and Family Leave

Graduate students have an option to get affordable health insurance coverage through the Graduate School as part of the TBP. TA’s and RA’s are generally eligible, but unfortunately transitional TA’s are not (yet are still required to show proof of insurance on arrival—please ask Krista…). Here are details:

https://gradschool.utah.edu/tbp/insurance.php

Students who need time off for care---giving and bonding with a newborn child can take a period of up to 12 weeks for a family leave of absence. The Department of Physics and Astronomy offers financial support to TA’s and RA’s on family leave at their usual rate of compensation. Please talk with the Graduate Coordinator if you wish to apply for family leave.

2.3. ADMINISTRATIVE AND ACADEMIC TASKS

This section presents a to---do list, more or less in chronological order, of things that you will need to complete your degree. Unless otherwise noted, these items apply to all our Ph.D. and M.S. programs.

• Prepare for and take COMMON EXAM. (May be required for Ph.D., depending on GRE Physics score, and encouraged for all grad students as a diagnostic test). This exam is given just before the beginning fall semester. It may help you to choose the right courses. (See Section 3.1.)

• Choose your courses in consultation with your Graduate Advisor. At the beginning of each semester meet with your research advisor or the faculty advisor assigned to you when you arrive. Discuss the courses you plan to take that semester and beyond. The University General Catalog lists possibilities:

  Physics courses:  http://www.acs.utah.edu/GenCatalog/crsdesc/phys.html
  Astronomy courses: http://www.acs.utah.edu/GenCatalog/crsdesc/astr.html

Focus on degree requirements and electives for your specialization. Consider waiving courses if you’ve had equivalent classes elsewhere (Section 2.4). Your Supervisory Committee must approve your Program of Study—the courses you need and any that can be waived—so form your committee as soon as possible (see below).
• **Register for courses.** To be a full—time student, you must take at least 9 credit hours per semester of courses numbered 5000 or above. Registration generates tuition bills, so know the rules regarding tuition benefits as explained below.

• **Arrange for your Tuition Benefits.** For you to receive Tuition Benefits, your advisor MUST sign a Tuition Benefits Program (TBP) form by a well—publicized date each semester. Be aware of the rules:  

  [Link](http://www.gradschool.utah.edu/tbp)

The following list is just a sample of the rules that affect our students the most:

  o Teaching Assistants (TA’s) must take 9—12 credit hours (Fall, Spring semesters only).
  o Research Assistants (RA’s) must take 9—11 credit hours (Fall/Spring) or 3 credits (Summer).
  o Registering for more than the maximum will result in a bill to your account.
  o You must keep your cumulative GPA at or above 3.0 to receive benefits.
  o The number of semesters during which you can receive benefits is limited:
    - 4 semesters for Master’s degree
    - 10 semesters for Ph.D. admitted without M.S.
    - 8 semesters for Ph.D. admitted with M.S. from another University.
  o Ph.D. students (no incoming M.S.) who TA 4 semesters get 2 more semesters of benefits.
  o For RA’s with 84+ credit hours, only “in—state” tuition is covered for non—research courses.

(In the last item, non—research courses are numbered below 7970. If you need to take such a class but are beyond your 84 credits, as the DoGS for help.)

• **Maintain full—time student status and tuition benefits.** If your drop a class mid—semester and you end up with 9 credit hours or less you may lose tuition benefits for that semester. If you need to drop a class, consult with the DoGS and the Graduate Coordinator. Also, RA/TA income must exceed a set amount (~4k) in a semester or your tuition benefits will be revoked. This is a rare problem, but it can happen, as when a student is promoted or dismissed from an RA position (see Section 2.6.2).

• **Set up your Supervisory Committee.** Find a research advisor—talk with students, meet with faculty, and attend seminars, group meetings and the yearly Graduate Symposium. Then, with your advisor’s help, ask other faculty to serve on your Supervisory Committee. Do so by the end of your second year for a Ph.D. This committee will be involved in many of the steps to come, such as approving your program of study, and administering all exams (e.g., Ph.D. qualifier, thesis defense). There are rules for committee membership, described in Chapter 3 for each degree program, and steps to follow for formalizing your committee. Please ask our Graduate Coordinator Krista Perkins for details. (see Appendix A for more information)

• **Establish your Program of Study.** Meet with your committee to formally decide what coursework is required of you and whether you can waive any required courses because of previous coursework (Sect. 2.4). This meeting should take place in the semester that you form your Supervisory Committee. During the meeting your committee may discuss what material will be covered in the Ph.D. Qualifying Exam or M.S. Final Exam (e.g., the instrumentation project presentation for the MSI).

• **Keep your grades up.** You need a minimum cumulative 3.0 GPA to receive tuition benefits, and you need this minimum to graduate, no matter what. See Section 2.5 for more grading policy information.
• **Wrap up coursework, start engaging research.** This step should happen at the very latest by the third semester for a M.S. degree, or fifth semester for a Ph.D. This is part should be fun.

• **Propose a research project (M.S. only).** You must decide on a research project and then propose it to your Supervisory Committee. The proposal may take written form, or it may be an oral presentation, as in the M.S.I. program.

• **Take the Qualifying Exam (Ph.D. only).** This exam, administered by your Supervisory Committee before the end of your third year, tests preparedness for doctoral research. The committee discusses format and content beforehand, typically when the Program of Study is arranged. Usually, you will give a short oral presentation about your intended specialization. Committee members may ask questions on that topic or on general grad---level physics. You may repeat the exam only once.

• **Become a Legal Resident of the State of Utah (Ph.D., domestic non---residents only).** Tuition Benefits covers tuition at the Utah resident after a total of 84 credit hours has been accumulated. Thus, if you can, become a resident of Utah. You are qualified to apply after 40---60 credit hours; see Section 4.1.2 of Utah Code R512, Determination of Resident Status. The Graduate Coordinator can help.

• **Obtain a milestone M.S. degree (Ph.D. only).** Once you have obtained sufficient number of credit hours (30 total; at least 12 in coursework, plus 6 in research), and have passed the Qualifying Exam, you can arrange to get a non---thesis Master’s in Physics as part of your trajectory toward a Ph.D. The Graduate Coordinator can help with the administrative aspects of this process.

• **Do your research.** This work is the heart of your degree program. Your advisor and supervisory committee oversee your work and progress. Timeframe: about one year (M.S.) to four years (Ph.D.).

• **Write up your Thesis (Ph.D. and M.S., except for MSI and milestone MS).** There is no set prescription or length for writing your thesis, but there stringent rules, and helpful suggestions:


  The only other rule is that this step will take longer than you think.

• **Formally apply for graduation.** This is a formal step newly required by the Registrar’s Office and must be done no earlier than one year prior to graduation. See

  Applying for Graduation: [http://www.sa.utah.edu/regist/graduation/applying.htm](http://www.sa.utah.edu/regist/graduation/applying.htm)

• **Defend Thesis/Final Project.** This final exam is required for all of our graduate degrees. For a Ph.D. and thesis--based M.S., you should have a final draft of your thesis submitted to your committee members no less than two weeks prior to your defense. The defense typically consists of a public lecture, followed by a closed---door oral examination by the Supervisory Committee. For non---thesis project---based Master’s, the format is the similar, unless otherwise specified.

• **Check: Is it official?** When the thesis or final project is successfully defended, a Report of the Final Exam or Certification of Completion (non---thesis option) will appear online. If yours is a non---thesis degree, congratulations! You are done.
• **Obtain Final Reading Approval and submit your thesis (Ph.D. and thesis---based MS).** These are the last steps. You should follow the guidelines at


• **Time limit.** One last detail: You must finish all of the above steps in the period of time allotted by the Graduate School (4 calendar years for a M.S., 7 years for a Ph.D.). This is a merciful rule: Grad school might seem interminable, but it really isn’t. If you need more time, there are options (Section 2.6).

That is the path to your degree! Along the way, you can track your progress with the Electronic Graduate Record File system. Contact the Graduate Coordinator, Krista Perkins, for more information.

### 2.4. Timetables for Degree Programs

#### Ph.D. program example timetable

<table>
<thead>
<tr>
<th>Year 1---2</th>
<th>Year 2---3</th>
<th>Year 3---4</th>
<th>Year 4---6</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Meet assigned advisor</em></td>
<td><em>Take Courses</em></td>
<td><em>Electives (?)</em></td>
<td><em>Write thesis</em></td>
</tr>
<tr>
<td><em>Common exam (if req’d)</em></td>
<td><em>Program of Study (form)</em></td>
<td><em>Research (yes!)</em></td>
<td><em>Apply to Graduate (form)</em></td>
</tr>
<tr>
<td><em>Take Courses</em></td>
<td><em>Qualifying Exam</em></td>
<td><em>Thesis Defense!</em></td>
<td><em>Thesis Defense</em></td>
</tr>
<tr>
<td><em>Seek thesis project</em></td>
<td><em>Milestone M.S. degree!</em></td>
<td><em>Report of Final Exam (form)</em></td>
<td><em>Report of Final Exam (form)</em></td>
</tr>
<tr>
<td><em>Set up Thesis Supervisory Committee (form)</em></td>
<td></td>
<td><em>Final Thesis Reading (form)</em></td>
<td></td>
</tr>
</tbody>
</table>

#### M.S. program example timetable

<table>
<thead>
<tr>
<th>Year 1---2</th>
<th>Year 2---3</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Meet assigned advisor/Common Exam (if recommended)</em></td>
<td><em>Research + elective coursework</em></td>
</tr>
<tr>
<td><em>Take Courses</em></td>
<td><em>Write thesis/Project report</em></td>
</tr>
<tr>
<td><em>Seek M.S. project</em></td>
<td><em>Apply to Graduate (form)</em></td>
</tr>
<tr>
<td><em>Set up Supervisory Committee (form)</em></td>
<td><em>Thesis Defense/Final exam</em></td>
</tr>
<tr>
<td><em>Program of Study (form)</em></td>
<td><em>Report of Final Exam (form)</em></td>
</tr>
<tr>
<td><em>Project Proposal</em></td>
<td><em>Final Thesis Reading, if applicable (form)</em></td>
</tr>
</tbody>
</table>

### 2.5. Getting Course Credit: Transfers, Waivers and Grading Policy

• **The University’s minimum course requirements.** Each degree program has a minimum number of credit hours. For the M.S. degree, it’s 30 credit hours, of which 9---12 must be in coursework, and 6 in project/research credits (PHYS 6950/6970). The University is less strict for the Ph.D.: 14 research credit hours (PHYS 7970). However our Department’s degree program has additional requirements.

• **Transferring course credits.** Often graduate students arrive after having taken graduate courses at another institution. If you intend to get a master’s degree only, then transfer up to the maximum allowance of 6 credit hours. These credits will count toward the 30 credit hours required for the M.S. degree. For a Ph.D., it is better to waive course requirements (see below) than to transfer credits.
• If you transfer to the U with a newly---hired advisor, and you become a student here, your advisor, Supervisory Committee and the DoGS will help to minimize the impact on you regarding courses.

• Waiving required courses. We do not want you to repeat unnecessary coursework. If you have taken a required course at another institution, then request that the requirement be waived. Contact the instructor who teaches that course here, and compare what you’ve had with what we offer. If the comparison is favorable, request that the instructor send a brief statement (by email) to Krista saying that you have already studied similar material (e.g., used an equivalent text book). Alternatively, you may satisfy a course requirement by taking that course’s comprehensive final exam and obtaining a grade of B or better. You need not register for the course but must have prior permission from the instructor before attempting the final exam. The instructor would report the exam score to Krista. The Supervisory Committee and the DoGS have the final decision on all course waivers.

• Grading Policy. The Department 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---, and Ph.D. student must earn B. A more detailed summary of grades is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Very good, expected for M.S. and Ph.D.</td>
<td></td>
</tr>
<tr>
<td>A---</td>
<td>Good, acceptable for M.S. and Ph.D.</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>Acceptable for M.S. and passable for Ph.D.</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Passable at M.S. level, marginally passable at Ph.D. level</td>
<td></td>
</tr>
<tr>
<td>B---</td>
<td>Marginally passable for M.S., unacceptable at Ph.D. level</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Unacceptable for graduate work in the Department of Physics &amp; Astronomy</td>
<td></td>
</tr>
</tbody>
</table>

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.

• Appeals. If you disagree with a grade, you may make an appeal to have your work reevaluated. The first step is to talk with your instructor. If you wish to take your appeal further, consult with the DoGS, Department Chair, and the Graduate School, preferably in that order. See Section IV---B of the Code of Student Rights and Responsibilities,

Student Code:  http://regulations.utah.edu/academics/6-400.php

• Required Examinations. Exams such as the Common Exam and Qualifier are degree requirements and are all pass---fail in nature. In some cases, you may be given one chance to retake the exam, or a part it.

2.6. ACADEMIC PROGRESS

Previous sections list the general flow of progress as you work toward your degree. In this section we cover issues that will help you gauge your progress (Section 2.6.1), and what the options are if you should wish to change your plan. For example, it is not uncommon to change research advisors (Section 2.6.2). We also consider the possibility of—and limitations to—putting some distance between you and the U (Section 2.6.3, on residency requirements) or taking some time off (Section 2.6.4).
2.6.1. Good Academic Standing

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

- Maintain a cumulative GPA is 3.0 or above.
- Satisfy Common Exam requirement by the end of the second year
- Form the Supervisory Committee by the end of the second year (earlier is better).
- Complete core coursework by the end of the third year for Ph.D.
- Pass required exams in a timely manner (e.g., end of year three for the Ph.D. qualifier).
- Achieve satisfactory advances in research, as judged by the research advisor.

Satisfying these benchmarks means you are a student in good standing. Failure to meet any of them may be grounds for dismissal from the graduate program. Please seek help from your advisor or the DoGS if you want to stay in the program but are having difficulties making adequate progress.

2.6.2. Change of Research Advisors.

A research advisor serves as a student’s mentor, the chair of the student’s supervisory committee and often is responsible for managing funds for research assistantships (RA’s). This formal relationship has helped launch many successful careers for grad students. However, occasionally it may be necessary for a student to change advisors. If you and your advisor agree upon such a change, then you should notify the Graduate Coordinator, who can help with formalities. In absence of such an agreement, a student or advisor may unilaterally seek to terminate the advising/research relationship. If you initiate the process, then write a note to your advisor 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 your research. Keep in mind that your advisor would not be obliged to pay any RA salary after that timeframe. If the advisor initiates termination of the research relationship, then:

- The advisor should write a note to the student 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. This step may help identify and resolve the main problems.
- If the student fails to meet these goals, then the advisor should provide the student with written notice to terminate the research relationship, 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 may be terminated no earlier than the date specified by the termination notice, unless the student receives support from another source (e.g., TA or RA from another advisor) before that date.
- The student is obligated to turn over to the advisor all material (notebooks, equipment, data) related to the advisor’s research.

All correspondence should be copied to Krista. Be aware of potential tuition benefit implications if RA support is terminated mid-semester. Appeals should go to the Chair, then to the Office of the Associate Dean for Student Affairs in the College of Science for independent review. (See University Policy concerning Student’s Rights and Responsibilities for more information.)

2.6.3. Change of Address: Residency Requirement.

It is generally a good idea to be on-campus for the duration of your degree program. If this is not possible, be aware of these Graduate School rules. They differ for Master’s and doctoral degrees.

- M.S.: You must be in-residence while taking 24 of your 30 required credit hours.
- Ph.D.: You must be in residence for two consecutive semesters (excluding Summer).
In both cases, “in residence” refers to being at the University of Utah doing “full-time academic work,” i.e., actively taking courses or doing research, presumably on campus.

2.6.4. Time out: Leave of Absence, Time-limit Extensions and Dematriculation

You are expected to enter grad school and remain a continuously registered student until graduation. But sometimes, people need a break. Here we discuss how to arrange for time away from your graduate program, or for more time to finish your degree than is provided by the Tuition Benefits Program.

• Leave of Absence. Sometimes in the course of a graduate program it is necessary for a student to take time off for an extended period of time. Reasons include:
  o Family Leave, pregnancy and child care.
  o Military service
  o Sickness, or illness in your family
  o Conflict with outside work, especially if related to academic goals

If you need to temporarily leave graduate school, meet with your advisor. S/he, along with the Department Chair, must petition the Graduate School for an official leave of absence. A leave is granted for one-year intervals. See the Grad School website (below) for details.

• Returning to the program after an absence. If the student took an official leave of absence, or maintained the minimum continuous registration, then there is no special arrangement necessary for the student’s return. Unfortunately, if the student did have a lapse in registration without a leave, then the student must reapply to the program. If this is you, please consult the Graduate School policy for details of how (e.g.) tuition benefits are affected. We will try to make things smooth for you.

• Extending your stay or going part-time. There are options for extending your tenure as a graduate student. One is to maintain the minimum continuous registration, typically by enrolling for 3 credit hours. While you cannot claim Tuition Benefits with less than 9 credit hours, you can maintain your status as a graduate student in good standing at a relatively small cost. Note that you may have to reapply if you attempt to remain registered for more than 7 years. See this link for more information:
  Continuing registration: http://www.gradschool.utah.edu/catalog/registration.php

• Dematriculation. While most of students succeed in our programs, sometimes are situations when graduation is not an option. Failing to pass a required exam is an example. Also, gross ethical or legal misconduct by a student is grounds for dismissal. Finally a student will be “dematriculated” if enrolled past the allowed time to complete a degree (4 calendar years for a M.S., 7 years for a Ph.D.), although in this case the student might reapply. (We are unsure if dematriculation is a real word. Please do not find out. See UofU Policy concerning Student’s Rights and Responsibilities)

Here we end our rather detailed, but hopefully helpful, description of the administrative aspects of our grad program. We have only to remind you that while the Department has its requirements, written herein, the Grad School’s rules are immutable and unyielding. It’s best to know them well:

3. DEGREE PROGRAMS

Selecting your degree

In this section we outline our degree offerings, starting with the traditional physics Ph.D. and including degrees with emphasis in specialized areas. To select your doctoral program you should apply as a doctoral student in Physics, but specify the area of emphasis (if any) on your application. For the Master’s programs, you may apply directly for M.S. Instrumentation (MSI) or M.S. Computational Physics programs; the M.S. Physics degree is also offered as part of the Ph.D. program.

Degrees offered by the Department of Physics and Astronomy

- Ph.D. Physics (including Physics Education specialization)
- Ph.D. Physics with Astronomy & Astrophysics Emphasis
- Ph.D. Physics with Medical Physics Emphasis (Medical Physics Doctoral Program)
- Ph.D. Chemical Physics (Interdisciplinary, with Department of Chemistry)
- M.S. Physics
- M.S. Physics with Instrumentation Emphasis (MSI Program)
- M.S. Physics with Computational Physics Emphasis (Master’s in Computational Physics)

Related Degrees

- M.S. Computational Engineering and Science (CES). An interdisciplinary degree that allows students to incorporate advanced simulation techniques into their research. May be done as part of a Ph.D. degree. For more information, please check out MS CES Program: [http://www.ces.utah.edu](http://www.ces.utah.edu)
- 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: [http://web.utah.edu/pmst](http://web.utah.edu/pmst)

In what follows you will find specific degree requirements, but note that these requirements have built-in flexibility so that you can make the most out of your graduate studies.
PHYSICS DOCTORAL PROGRAM

3.1. Ph.D. in Physics

Overview

The Ph.D. in physics is for those students who wish to study physics, biophysics, nanoscience and astronomy. It is our premier degree offering.

A Ph.D. is different from other advanced degrees because to earn one, you must do original academic work. As in a Master’s program, coursework is excellent and rewarding, but the Ph.D. is about research. Thus, it is never too early to find an advisor to direct your research. Once you pass an initial proficiency benchmark, the Common Exam, you can establish a Supervisory Committee, which oversees your doctoral work with your advisor as its chair. As you get a little experience doing research, your Supervisory Committee will give you a Qualifying Exam to see if you are ready to take on your thesis project. It is this project that may define your professional career.

Along the way to your Ph.D., you may wish to earn a “milestone” Master’s degree, since it will not interfere with your progress toward a doctoral degree. Meanwhile, here is what you will have to do for a Ph.D. in Physics. Also see the General Administrative Requirements section for additional details.

Required Degree Elements

- Common Exam (or Physics GRE equivalent)
- Form Supervisory Committee (see Appendix A for more information)
  - Core Courses:
    - PHYS 7110 Classical Mechanics/E&M I (4 credit hours)
    - PHYS 7120 E&M II (4)
    - PHYS 7220 Quantum Theory I (4)
    - PHYS 7230 Quantum Theory II (4)
    - PHYS 7310 Statistical Mechanics (3)
    - PHYS 7740 Math Methods I (4)
  - Graduate Laboratory Course: PHYS 6719 or equivalent (3 credit hours)
  - PHYS 7800 (2 credit hours) or PHYS 7810 (1---2 credit---hours) Colloquium Course (first 6 semesters or 4 semesters + 2 seminars programs)
  - Breadth Requirement: graduate physics course outside area of specialization (3+ credit hours)
  - Electives: Any graduate courses needed for specialization
  - Extra Preparatory Courses (optional)
  - Program of Study Approval
  - Qualifying Exam
  - Milestone Master’s degree (recommended)
  - Thesis Research (14---credit hours minimum)
  - Thesis Defense

Note: To pass a course for credit toward a Ph.D. in Physics requires a grade of B or better. In addition, to receive graduate credit, the course number must be 5000 or above.
**Description of Required Elements**

- **The Common Exam.** This written test, based on advanced undergraduate physics material, is designed to determine if a student’s background knowledge of physics is sufficient to proceed into the Ph.D. program. The exam is administered just before the start of each Fall semester; you should take it just before your first-year classes. A passing score is typically around 50% or above. If you do not pass, you may retake the exam at the beginning of your second year. Note: you can satisfy this requirement (equivalent to passing the Exam) by attaining a GRE Physics Subject Test score at or above a value set by the Department (around the 50th percentile) at any time until the end of the calendar year following your second attempt at the Common Exam. Please see: Common Exam: [www.physics.utah.edu/index.php/graduate---program/common---exam---a---gre](http://www.physics.utah.edu/index.php/graduate---program/common---exam---a---gre)

- **Supervisory Committee.** Once you pass the Common Exam, you should form your Supervisory Committee as soon as you have ascertained an area of interest for your thesis research. Your thesis advisor is typically the chair. Five faculty members must be on the committee; the majority—including the chair—must be regular faculty in the Department. One faculty member must be from another department or university. One of the Department faculty members must be in an area of specialization that is unrelated to your own field, for example a theorist if you are an experimentalist. see Appendix A for more information

- **Core courses.** All students are required to take our core courses (or their equivalent elsewhere—see below on waiving a course requirement) Note: until the U approves Ph.D. emphases in astrophysics and biophysics, the supervisory committees will set the core curriculum for students in those fields.)

- **Graduate Laboratory Course.** The purpose of the Grad Lab requirement is to help you take and interpret experimental and observational data, to understand the quantitative implications of various sources of error and uncertainty, and to compare data with theoretical or computational models. The standard course for satisfying this requirement is PHYS 6719; other possibilities include PHYS 6770+6775 (lecture+lab—both are required), ASTR 5015, and ASTR 6410 (see Appendix B).

- **Colloquium Course.** This requirement means you must attend the Department Colloquium during your first two years. In your third year you may attend either the Colloquium or one of the more specialized Graduate Seminars. Sign up for PHYS 7810 for 1 credit hour (Colloquium) or 1—2 credit hours (Grad Seminar). Take PHYS 7800 for 2 credit hours (Colloquium). Your grade is attendance—based. If you are taking too many other classes to sign up for these courses, you must still go to the Colloquium/Seminars, and your attendance will still be recorded.

- **Electives.** You may take elective (non-core) courses to satisfy your own curiosity, or because they may be needed for your thesis research. In the latter case, your supervisory committee can actually elect to require specific courses for your program of study. Please talk with your thesis advisor!

- **Breadth requirement.** Your breadth course must be in a physics subject area that is unrelated to your specialization. It cannot be otherwise required. To find a breadth course, try categorizing your specialty and our course offerings into Experiment, Theory and Computation. If you fall into one area, choose a course from another. Example: a condensed matter experimentalist might take General Relativity or Computers in Physics. Or cross disciplines: that same experimentalist could take an astronomy course or particle & nuclear physics. Avoid neighboring disciplines (e.g., condensed matter and optics) and courses that look “broad” but really are needed as part of a student’s specialization.
• **Extra preparatory courses.** If your undergraduate training in physics is not as strong as you would like, you should consider prep courses like PHYS 5010/5020 (see table below). To help with computer literacy (expected of all physics grad students), try PHYS 6720 (Intro to Computing in Physics; this course may also satisfy your breadth requirement).

• **Course requirement waivers.** If you have taken a required course at another institution, then request that the requirement be waived. Section 2.4 above describes the procedure, but briefly, you may waive a course requirement by getting a note from the instructor that you’ve taken an equivalent course elsewhere (e.g., you used the same textbook) or by making prior arrangements with the instructor to take the course’s comprehensive final exam, then passing the exam.

• **Program of Study.** The final list of core + elective courses that you must take is determined by your Supervisory Committee. Typically you meet with your Committee as soon as it is officially formed to decide on the Program of Study. This is a contract to establish what courses you need for your Ph.D.

• **Qualifying exam.** This exam serves to establish that you are ready to take on your doctoral research project. You can take it as soon as you have passed the Common Exam and have established a Supervisory Committee, no later than the end of your third year. Often, students take the qualifier after initiating potential thesis research. The Committee informs you of the format of the exam and the material to be tested, normally at the same time that your Program of Study is approved. A typical qualifier will start with a 20---40 minute presentation on a possible research topic, followed by questions from the Committee.

• **Research credits.** We require a minimum of 14 credit hours of in---residence research for graduation.

• **Thesis defense.** In the tradition of the doctoral degree, you must defend your thesis. Here we describe three parts of this process. First you must give a final draft of your thesis to your committee members no later than **two weeks prior** to the date of your defense. In the second part you give a public talk (well under 1 hour is good) followed by a closed---door oral exam on your work, given by your Committee. Your final step is to modify your thesis following the results of the defense and submit it in accordance with University policy (see the Graduate School’s Thesis Office website).

**Course Curriculum**

The following table shows three sample curricula, or tracks. The first, Track A, is for a well---prepared student (e.g., high Physics GRE or Common Exam score); Track B is for is for a student who is prepared but needs a lower workload (for example, if a course for TA training is also required). Track C provides additional preparation. Consult with your graduate advisor to determine which track is right for you.

**NOTE:** These tracks are guidelines only. The goal is to get through your core courses quickly and on to research. Avoid repeating courses you have taken elsewhere, especially if you entered with a M.S. degree. Your advisor can help customize your curriculum.

**PITFALLS:** Watch the maximum allowed credit---hours: 12 for TA, 11 for RA. In all cases colloquium attendance is monitored and required, even if your schedule does not permit registering for the PHYS 7800/7810 Colloquium course. If you find yourself struggling as the semester proceeds, then ask your instructors, advisor or the DoGS for help!
**PHYSICS PH.D. COURSE CURRICULUM**

<table>
<thead>
<tr>
<th>Track A*</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td>PHYS 7110, Class. Mech/E&amp;M I ** (4)</td>
<td>PHYS 6719, Grad Lab (3)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7220, Quantum Theory I (4)</td>
<td>PHYS 7120, E&amp;M II (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7740, Math Methods I (4) (Colloquium attendance required)</td>
<td>PHYS 7230, Quantum Theory II (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7810, Colloquium (1)</td>
<td>PHYS 7810, Colloquium (1)</td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td>PHYS 7310, Stat. Mech. (3)</td>
<td>PHYS 7800, Colloquium (2)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7800, Colloquium (2)</td>
<td>*** (7---10)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Track B</th>
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<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td>PHYS 7110, Class. Mech./E&amp;M I (4)</td>
<td>PHYS 6719, Grad Lab (3)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7740, Math Methods I (4)</td>
<td>PHYS 7120, E&amp;M II (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7800, Colloquium (2)</td>
<td>PHYS 7800, Colloquium (2)</td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td>PHYS 7220, Quantum Theory I (4)</td>
<td>PHYS 7230, Quantum Theory II (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7310, Stat. Mech. (3)</td>
<td>PHYS 7800, Colloquium (2)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7800, Colloquium (2)</td>
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</table>

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<tr>
<th>Track C</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td>PHYS 5010, Class. Mech./QM (3)</td>
<td>PHYS 5020, E&amp;M/Stat. Mech. (3)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7740, Math Methods I (4)</td>
<td>PHYS 6719, Grad Lab (3)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7800, Colloquium (2)</td>
<td>PHYS 7810, Colloquium (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*** (2--5)</td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td>PHYS 7110, Class. Mech./E&amp;M I (4)</td>
<td>PHYS 7120, E&amp;M II (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7220, Quantum Theory I (3)</td>
<td>PHYS 7230, Quantum Theory II (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7800, Colloquium (2)</td>
<td>PHYS 7800, Colloquium (2)</td>
</tr>
<tr>
<td><strong>Year 3</strong></td>
<td>PHYS 7310, Stat. Mech. (3)</td>
<td>PHYS 7800, Colloquium (2)</td>
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<tr>
<td></td>
<td>PHYS 7800, Colloquium (2)</td>
<td>*** (7---10)</td>
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</tbody>
</table>

*Curriculum tracks distinguish plans for students entering with varying levels of preparedness. Track A may be for a student entering with a Master’s degree or a high Physics GRE score; Track C may be for a student who does not pass the Common Exam. **Note: Students taking English credits in the Fall of first year cannot do Track A. Track B is an option, or consider doing Track A except with Math Methods I in the Fall of second year.**

**The courses listed are required/recommended for Ph.D. candidates. Credit hours for each course are shown in parentheses. For Colloquium/Seminar credits, sign up for PHYS 7800; for 1 credit hour (or 1---2 credit hours of Grad Seminar) register for PHYS 7810.**

***In their program of study, students may take Special Reading courses, Research credits, Electives, or a course to satisfy the Breadth Requirement. Note: a total of 9---12 credit hours in a semester is required for Tuition Benefits eligibility for TA’s, 9---11 credit---hours for RA’s.
Summary of Administrative items

Here is a list, in chronological order, of the administrative benchmarks you must reach on your way to your degree:

- Common Exam (before first semester, and second semester if necessary)
- Advising sessions (start of each semester, see Appendix A for more information)
- Form Supervisory Committee (after passing Common Exam, see Appendix A for more information)
- Program of Study
- Qualifying Exam
- Milestone Master (optional)
- Apply for Graduation
- Thesis Defense
- Final Reading/Submit defended thesis to Thesis Office for Format Approval

Details on how to accomplish some of these tasks are listed in the General Administrative Requirements section of this handbook. Note that the maximum time to complete the degree, including semesters with the minimum Continuing Registration (PHYS 7990), is 7 calendar years from time of matriculation.
ASTRONOMY & ASTROPHYSICS

3.1.1. Ph.D. in Physics with Astronomy & Astrophysics Emphasis

Overview

Our faculty work on a wide range of observational and theoretical topics, including cosmology, extragalactic and Galactic astronomy, the large-scale structure of the Universe, and the origin of planetary systems. We are an institutional partner in the Sloan Digital Sky Survey III, VERITAS (gamma-ray observatory), and the Telescope Array (cosmic rays). We observe on the Hubble Space Telescope and the SWIFT spacecraft, as well as on world-class ground-based telescopes, including Subaru, MMT, and Apache Point. We also operate a 0.8-m telescope in southern Utah designed to give students hands-on observing experience. Opportunities for research abound!

Potential research advisors include:

- Adam Bolton (observational cosmology and galaxy evolution)
- Ben Bromley (theoretical astrophysics, origin of solar systems, galactic dynamics)
- Kyle Dawson (observational cosmology, instrumentation)
- Paolo Gondolo (cosmology, high-energy theory, dark matter)
- Inese Ivans (observational galactic archaeology and stellar populations)
- Dave Kieda (gamma-ray astronomy, active galactic nuclei)
- Stephan LeBohec (gamma-ray astronomy, active galactic nuclei)
- Pearl Sandick (cosmology, particle phenomenology, dark matter)
- Anil Seth (observational astronomy, galaxy nuclei, nearby galaxy histories)
- Wayne Springer (particle astrophysics)
- Daniel Wik (X-ray astronomy, galaxies & clusters, black holes, cosmology)
- Gail Zasowski (Galactic archaeology, the Milky Way, stellar populations, ISM)
- Zheng Zheng (theoretical astrophysics, cosmology, galaxy formation and evolution)

Please see: http://www.physics.utah.edu/astronomy for more information.
Required Degree Elements

- Common Exam
- The following core courses:
  - ASTR 6410 Grad Research in Astronomy & Astrophysics (3 credit hours)
  - PHYS 7110 Classical Mechanics/E&M I (4)
  - ASTR 7130 Radiative Processes or PHYS 7120 E&M II (4)
  - PHYS 7220 Quantum Theory I (4)
- Three or more of the following courses, at least one of which must be at the 7000 level:
  - ASTR 5015 Observational Methods and Data Analysis (3)
  - ASTR 5560 Stars and Stellar Populations (3)
  - ASTR 5570 Galaxies (3)
  - ASTR 5580 Cosmology (3)
  - ASTR 5590 Stellar Astrophysics (3)
  - PHYS 7310 Statistical Mechanics (3)
  - PHYS 7640 Quantum Field Theory I (or PHYS 7650 QFT II) (3)
  - PHYS 7720 General Relativity and Relativistic Astrophysics (3)
  - ASTR 7730 Mathematical Methods for Astrophysics (3)
  - Any of the following courses, to be developed within the next five years:
    - Galactic Dynamics, Cosmochemistry, Data Mining, Advanced Particle Physics, Gas Dynamics/Hydrodynamics, Compact Objects.
- PHYS 7800 (2 credit---hours) or 7810 (1---2 credit hours) Colloquium Course (first 6 semesters);
- Breadth Requirement: graduate---level physics course outside area of specialization (3 credit hours)
- Electives: Any 5000---level or above course(s) needed for specialization
- Program of Study Approval
- Qualifying Exam
- Research Credits (6970, recommended)
- Milestone Master’s (recommended)
- Thesis Research (14---credit hours)
- Thesis Defense

Description of Required Elements:

This program leads to a Physics Ph.D., and is identical to the standard track except for the required courses and electives as listed above. These changes in the curriculum allow you to study physics in the broad context of astrophysical systems. To emphasize, all requirements such as the Common Exam, Qualifying Exam, are identical to those listed in Section 3.1. Please refer to the information contained therein.

- Research credits. You are strongly encouraged to familiarize yourself with the variety of research in the Department as soon as possible. Thus, consider taking supervised research credits (PHYS 6970, 3 credit hours) with one or more of the Astronomy/Astrophysics faculty; then you can participate in one or more short---term projects to help guide you toward your doctoral thesis research.

- Supervisory Committee. When you form your Supervisory Committee, make sure that you have one faculty member who is in the Department and NOT doing astrophysics or astronomy. For example, if you are doing work in observational astronomy, find a theorist in an area other than astrophysics.
• **Preparatory courses.** Some students may enter the Ph.D. program with a strong interest in astronomy, yet with no formal training. The core courses will cover the most important preparatory material but cannot cover all of the fundamentals in a semester. If you do not have much of an astronomy background, or want to familiarize yourself with the nomenclature and basic concepts, there are routes by which you can prepare yourself: (1) ask the instructors of the ASTR courses at the 5000---level or higher for advice on recommended reading --- what material would they consider to be Chapter Zero; (2) arrange to audit (with the instructor's permission) undergraduate classes that interest you; (3) ask about obtaining a teaching assistantship for an undergraduate astronomy class aimed at science students ----- you know the physics better than they do and you can learn the astrophysical applications together; and (4) get involved in research --- learning the background literature for well---defined projects and presenting results at national meetings such as the American Astronomical Society ([http://www.aas.org](http://www.aas.org)) or the American Physical Society ([http://www.aps.org](http://www.aps.org)) is a fun, efficient, and professional way of getting up to speed.

**Summary of Administrative items**

The list of academic and administrative benchmarks is the same as in the standard Physics Ph.D. case.

**PHYSICS Ph.D., ASTRONOMY & ASTROPHYSICS EMPHASIS COURSE CURRICULUM [1]**

<table>
<thead>
<tr>
<th>Odd</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>ASTR 5015 Obs. Methods (3)</td>
<td>ASTR 5560 Stars &amp; Stellar Pops. (3)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7110 Class. Mech./E&amp;M I (4)</td>
<td>ASTR 6410 Grad Research class (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7220 Quantum Theory I [2]</td>
<td>ASTR 7130 Radiative Processes (4)</td>
</tr>
<tr>
<td></td>
<td>PHYS 7810 Colloquium (1)</td>
<td>PHYS 7810 Colloquium (1)</td>
</tr>
<tr>
<td>Year 2</td>
<td>ASTR 5580 Cosmology (3)</td>
<td>ASTR 5570 Galaxies (3)</td>
</tr>
<tr>
<td></td>
<td>ASTR 7730 Astro Math---Meth (3)</td>
<td>PHYS 7810 Colloquium (1)</td>
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<td></td>
<td>PHYS 7810 Colloquium (1)</td>
<td>[PHYS 6970 Research AND/OR</td>
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<td>Breadth Requirement] (5--8)</td>
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<td>Even</td>
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<td>Spring Semester</td>
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<tr>
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<td>ASTR 5580 Cosmology (3)</td>
<td>ASTR 5570 Galaxies (3)</td>
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<td>ASTR 6410 Grad Research class (3)</td>
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<td>Breadth Requirement] (5--8)</td>
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<td>Year 2</td>
<td>ASTR 5015 Obs. Methods (3)</td>
<td>ASTR 5560 Stars &amp; Stellar Pops. (3)</td>
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<td>ASTR 7000—level TBD (3)</td>
<td>ASTR 7130 Radiative Process (4)</td>
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</tbody>
</table>

[1] Odd/Even tracks distinguish plans for students entering on odd years (Fall 2011, 2013,...) and even years (Fall 2012...). Courses listed explicitly with course numbers are required/recommended for the degree emphasis. Credit hours for each course are listed in parentheses. Note: a total of 9---12 credit hours per semester is required for Tuition Benefits for TA’s, 9---11 credit hours for RA’s.

[2] Students needing the 3 credit hour English fluency course may take PHYS 7220 in the Fall semester of the second year.
MEDICAL PHYSICS

3.1.2. PH.D. IN PHYSICS WITH MEDICAL PHYSICS EMPHASIS

Overview

Medical Physics is the application of physics as applied to medical imaging and radiation therapy. We offer a Ph.D. in Physics with Medical Emphasis, which is distinct from the Ph.D. programs described above. The UofU has an excellent medical program, and our graduate students have often branched into medicine through this degree offering, doing cutting-edge work in radiology, for example. This degree program will often 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 Institute (SCI). A list of possible research advisors includes

- Werner Gellerman (Physics & Astronomy; Raman spectroscopy in clinical ophthalmology).
- Brian Saam (Physics & Astronomy; MRI of lung with hyperpolarized noble gases).
- Dennis Parker (Radiology; MRI, MR angiography).
- Eun-Kee (E.K.) Jeong (Radiology, MR Physics, x-nuclei MR Imaging and Spectroscopy).
- Ed DiBella (Radiology; Dynamic MRI with cardiac applications, PET).
- Don Kadrmas (Radiology; PET physics, molecular imaging).
- Daniel Kim (Radiology)
- Chris Johnson (Scientific Computing and Imaging; parallel MRI).

For more information, please check out the following links.

- Utah Center for Advanced Imaging Research:  [http://www.ucair.med.utah.edu](http://www.ucair.med.utah.edu)

Required Degree Elements

- Common Exam (or Physics GRE equivalent)
- Core Courses:
  - PHYS 6719 Graduate Lab (or equivalent) (3 credit-hours)
  - PHYS 7110 Classical Mechanics/E&M I (4)
  - PHYS 7220 Quantum Theory I (4)
  - PHYS 7740 Math Methods I (4)
- PLUS two of the following courses:
  - PHYS 7120 E&M II (4)
  - PHYS 7230 Quantum Theory II (4)
  - PHYS 7310 Statistical Mechanics (3)
  - PHYS 7750 Math Methods II (4)
- PHYS 7800 (2 credit-hours) or PHYS 7810 (1-2 credit-hours) Colloquium Course (as in Physics Ph.D.)
- Breadth Requirement: graduate-level physics course outside area of specialization (3 credit-hours)
- Electives: Any graduate courses needed for specialization.
- Program of Study Approval
- Qualifying Exam
- Milestone Master’s (M.S. in Physics; recommended)
- Thesis Research (14-credit hours)
- Thesis Defense
**Description of Required Elements**

The requirements for the Medical Physics program are similar to those of the standard Physics Ph.D., except for the specific required courses and electives as listed above. Here are details:

- **The Common Exam.** All entering Medical Physics students need to take the Common Exam as the Physics predoctoral students. Please see:
  

- **Supervisory Committee.** Your thesis advisor may be from another department, but cannot technically serve as the chair of your Supervisory Committee without an exception from the Graduate School. There is no problem, since you only need to find a regular faculty member in the Department (preferably one in a field related to your research) willing to serve as chair. Then, the usual rules apply: For example, a majority of the five members must be regular faculty in the Department; one of this majority must not specialize in your area of research; one committee member must be from another department or university—two external members is better if one of them is your advisor.

- **Core courses.** As with the standard physics degree you have to take core courses. However, the list is slightly shorter to accommodate a more extensive set of electives, from which you get to choose two courses. Your research advisor and Supervisory Committee will help. Note: the Grad Lab requirement may be satisfied with PHYS 6719, or you may choose an equivalent course such as PHYS 6770/6775 (the lecture and lab parts of Optical Measurements) or Prof. Jeong’s MRI Lab (currently taught as PHYS 7910, special topics)—see Appendix B. Again, please consult with your advisor for guidance.

- **Colloquium credits.** The requirement can be satisfied the same as in the Physics Ph.D., but students may get credit for PHYS 7800/7810 while attending more specialized seminars, like UCAIR’s RECON series. Just make arrangements with your advisor and our Graduate Coordinator, Krista Perkins.

- **Elective and breadth courses.** Electives will typically focus on your area of specialization, while the breadth course gives you exposure to fresh ideas outside of your discipline. Each specialization (e.g., radiology) will have its own list of core course that you will take as “electives.” Your research advisor will guide you. Examples:
  
  - PHYS 6950: Special Topic, Physics of Magnetic Resonance Imaging, (2---3 credit hours)
  - PHYSL 5200 (Physiology) Principles of Physiology (5)
  - PHYSL 6050 (Physiology) General Physiology (2)
  - BIOEN 5401 (Bioengineering) Medical Imaging Systems (3)
  - RDLGY 7310 (Radiology) Advanced Topics in Magnetic Resonance Imaging (3)
  - RDLGY 7320 (Radiology) 3D Reconstruction Techniques in Medical Imaging (3)

- **Program of Study.** The final list of courses that you must take is determined by your thesis Supervisory Committee. With the possibility of needing more “electives” to learn the fundamentals of your discipline, you should convene your Committee as soon as possible.

**Summary of Administrative items**

The list of academic and administrative benchmarks is the same as for the standard Physics Ph.D.
3.1.3. Ph.D. in Physics: Physics Education Specialization

Overview

The Department of Physics & Astronomy is involved in research and development activities in Physics Education. A Ph.D. candidate interested in the teaching of physics and in the research underpinnings of that teaching may wish to undertake a thesis topic in physics education leading toward a Ph.D. in Physics.

A number of faculty members in Physics & Astronomy are willing to assume responsibility for supervising thesis research in this area. The DoGS or the Department Chair will know who among the faculty currently is involved in innovative educational projects or research within the University.

Degree Requirements

The degree conferred in this program is a Ph.D. in Physics, and has all the formal requirements described above. The main difference is a fundamental shift in focus of the Ph.D. research project to explore teaching and learning in physics. The Program of Study of a Physics Education student therefore may be modified accordingly, as deemed necessary by the Supervisory Committee.

Course Curriculum

A student in Physics Education should take the Physics Ph.D. core courses, but may take electives that come from other Departments, such as Education and Philosophy.

Summary of Administrative items

The administrative issues for this degree are the unchanged from the description above. However, you should be aware that your research project, if it involves students, would require Institutional Review Board approval. Usually anticipate no difficulties for a reasonably well-designed project, just know that it may have to happen. See

Institutional Review Board: http://www.research.utah.edu/irb/

Resources

Physics Education Research (PER) has become a mature physics specialization, applying methods of traditional physics analysis to problems in educating others about our subject. You can find more information here:

PER Central: http://www.compadre.org/per/wiki
UColorado’s PER site: http://www.colorado.edu/physics/EducationIssues
CHEMICAL PHYSICS

3.2. INTERDISCIPLINARY PH.D. IN CHEMICAL PHYSICS

Overview

Chemical physics concerns chemical processes from the perspective of atomic, molecular or condensed matter physics. The Ph.D. program in chemical physics is an interdisciplinary graduate curriculum permitting maximum flexibility to well-qualified graduate students. The Program of Study for the doctoral degree is administered by the Chemical Physics Executive Committee for the Departments of Chemistry and Physics & Astronomy. Course requirements are tailored to meet the need and interests of students on an individual basis in consultation with their Supervisory Committees. To enter this program you must first gain admission to the Physics (or Chemistry) Ph.D. program.

Faculty members available to supervise thesis research in this program include:

Physics & Astronomy:
- Christoph Boehme (condensed matter, spintronics)
- Carleton DeTar (computational physics)
- Jordan Gerton (nanostructures)
- Frank Harris (chemical physics)
- Brian Saam (atomic physics, hyperpolarized gases)
- Orest Symko (quasiperiodic crystals)
- Valy Vardeny (organic semiconductors)

Chemistry:
- Scott Anderson (reaction dynamics, nanoclusters)
- Peter Armentrout (chemistry of surfaces, ions, organometallic complexes)
- Michael Bartl (micro--- and nanophotonics)
- David Grant (NMR)
- Valeria Molinero (membrane transport, computational chemistry)
- Michael Morse (metallic and semiconductor systems)
- Jennifer Schumaker---Parry (plasmonic structures and nanoparticles)
- Thanh Truong (combustion chemistry, solvation, and zeolite catalysts)
- Charles Wight (computational chemistry, rocket propellants & explosives)

Degree Requirements

The degree requirements are determined on a case---by---case basis by the Chemical Physics Executive Committee and the student’s Supervisory Committee. As a guideline, if your home department is Physics & Astronomy, you will follow our Ph.D. program’s exam schedule. Only the courses differ from the “standard” Ph.D. in Physics: The curriculum will be customized for each student. It presumably is some combination the standard Physics Ph.D. track and Chemistry’s divisional tract in Physical Chemistry.

Summary of Administrative items.

The administrative requirements for this degree are similar to those of the Physics Ph.D, except that both the Chemical Physics Executive Committee and the Supervisory Committee must approve the Program of Study. Please contact the Graduate Coordinator for more information. Prof. DeTar and Morse have served most recently on the Executive Committee and can provide the best guidance.
Overview

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, although the student does not need to complete an extensive original research project as for the Ph.D. The Master’s is often conferred to students to acknowledge the completion (or near completion) of all but the doctoral research project, hence the name “milestone” Master’s. The degree is also an option for a student who decides to leave the Ph.D. program or who does not pass a Ph.D. requirement such as the Common Exam or Qualifier.

There are two types of M.S. degrees: thesis and non-thesis. The milestone Master’s is non-thesis degree for students seeking a Ph.D. If you are not going on to get a Ph.D., you are strongly encouraged to work toward a Master’s with a thesis.

Required Degree Elements

• Form Supervisory Committee (see Appendix A for more information)
• Graduate-level non-research courses (12 credit hours)
• Research courses (e.g. PHYS 6970; 6 credit hours)
• Additional graduate-level courses (12 credit hours)
• Program of Study Approval
• Thesis Defense or Final Examination (non-thesis option)

Note: To pass a course for credit toward a Master’s in Physics requires a grade of B- or better. In addition, to receive graduate credit, the course number must be 5000 or above.

Description of Required Elements

• Supervisory Committee. The committee consists of three faculty members. Two—including the chair—must be regular faculty in the Department. One and only one member must specialize in an area that is unrelated to your own field, for example, a theorist if your specialization is experimental.

• Courses. A necessary condition for getting a Master’s is the successful completion of 30 credit-hours of coursework. Unlike the Ph.D., there are no specific required courses, but the final Program of Study must reflect adequate training in Physics, as determined by the Supervisory Committee.

• Research Project, Thesis or Report. Your research project will be selected and agreed upon by you and your Supervisory Committee. In the case of a thesis-based Master’s degree, you must write up your results according to University guidelines (according to Grad School’s Thesis Office specifications; see Section 2.1). If you seek a non-thesis (milestone) M.S. as you progress toward your Ph.D., you may have some of the credits-hours from your doctoral research count for the master’s degree.

• Thesis Defense/Final Examination (non-thesis option). You will take an oral exam that begins with a short public presentation followed by a closed-door examination by the Supervisory Committee on your thesis work or research project. For the milestone Master’s, this requirement is typically satisfied during the same time and meeting at which you take your Ph.D. Qualifying Exam.
**Course Curriculum**

The curriculum depends on the student’s circumstances and the decisions of the Supervisory Committee. We anticipate that a Master’s student will have most of the core courses completed (certainly for a milestone degree); with 6 additional---credit hours of graduate research, the course requirements are satisfied. If a student wishes to graduate with a Physics M.S. without continuing on to a Ph.D., then s/he may do so with a reasonable schedule within two years. For example:

<table>
<thead>
<tr>
<th>Year</th>
<th>M.S. Curriculum</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PHYS 7740, Math Methods I</td>
<td>PHYS 6719, Grad Lab</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PHYS 6970, M.S. Thesis Research (elective)</td>
<td>PHYS 6970, M.S. Thesis Research (elective)</td>
<td></td>
</tr>
</tbody>
</table>

The Supervisory Committee must approve the electives. The implied two-—year time frame is recommended, because of the Tuition Benefit limitations for a M.S. degree (please consult with the Graduate Coordinator about benefits).

- **Milestone M.S. versus Ph.D. course credits.** In general that whatever course credits you use to satisfy the M.S. Physics degree cannot be used for any other graduate degree, M.S., Ph.D. or otherwise, here at the U. Even so, flexibility in degree requirements makes it straightforward to obtain both a M.S. and a Ph.D. without adding courses to the Ph.D. track.

**Summary of Administrative items**

Here is a list, in chronological order, of the administrative benchmarks you must reach on your way to your degree:

- Advising sessions (start of each semester, see Appendix A for more information)
- Form Supervisory Committee
- Program of Study
- Apply for Graduation
- Final Examination or Thesis Defense
- Submit defended thesis to Thesis Office for format approval (if applicable)

The maximum time allowed to complete a M.S. Physics degree is 4 calendar years from the date of matriculation.
THE MSI PROGRAM

3.4. PHYSICS M.S. WITH INSTRUMENTATION EMPHASIS

Overview

This 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 degree candidate is required to take part in an instrumentation project, which can be in a wide variety of research and industrial test areas. In many cases the project will occur in disciplines other than physics and can be performed in an industrial setting with appropriate departmental supervision. Projects related to a student’s profession are encouraged; indeed, as MSI students do not typically receive financial support from the Department, many pursue this degree while working full time in industry. Note that projects involving proprietary and/or confidential research can be accommodated. While this is a non-thesis Master’s degree, the successful project is fully documented and results in a detailed written report of the project.

Required Degree Elements:

• Form Supervisory Committee
• Required Core Courses:
  o PHYS 6610 Electronics for Scientific Instrumentation¹ (4 credit---hours)
  o PHYS 6620 Data Acquisition for Scientific Instrumentation¹ (4)
  o PHYS 6750 Applied Modern Optics I & II (4)
  o PHYS 6770 Optical Measurement Techniques & Instrumentation (4)
  o PHYS 6730 Computational Physics (4)
• Instrumentation Project Proposal
• Program of Study Approval
• Elective Courses
  o PHYS 5719 Fundamental Laboratory Techniques (2---3)
  o PHYS 5739 Microscopy (3---4)
  o PHYS 6771 Ionizing Radiation² (2)
  o Machine Shop³ (non-credit, 20 [real-time] hours)
• Research credits:
  o PHYS 6859 Instrumentation Project (6---10)
• Final Presentation and Written Report

Optional Preparatory Courses:
  o PHYS 5010 Theoretical Mechanics & Quantum Mechanics⁴ (3)
  o PHYS 5020 Theoretical E&M and Statistical Mechanics⁴ (3)
  o PHYS 6720 Introduction to Computing in Physics⁵ (4)

¹PHYS 6610 and 6620 are usually called Electronics I and Electronics II.
²PHYS 6771 is recommended but offered less frequently than the other courses.
³Machine shop is a non-credit, four-week training class offered by the Department.
⁴PHYS 5010/5020 are recommended (not required) for a broad Physics background.
⁵PHYS 6720 is recommended for experience with C++ and UNIX to prepare for PHYS 6730.
Description of Required Elements

Many elements of the MSI degree are the same as in the M.S. Physics program, such as the formation of the Supervisory Committee and Program of Study approval. There are differences, as we now describe.

- **Courses.** A total of 30 semester hours of credit are required to complete the program. Six to ten credit-hours will be related to the instrumentation project. Select courses above the 5000 level in physics, chemistry, mathematics, computer science, and engineering may be substituted for the instrumentation courses above with prior approval from a student's Supervisory Committee. These courses should be in fields relevant to the Instrumentation Project, although some may be preparatory in nature, if deemed necessary by the Supervisory Committee.

- **Instrumentation Project Proposal.** Before you begin your instrumentation projects, you must give an oral presentation to your Supervisory Committee describing your proposed project. Expect that your committee will ask you questions during and after your presentation.

- **Final presentation and Written Report.** A final formal oral presentation to the Supervisory committee of the project, and a detailed project write-up are required for completion of the degree. A copy of the Project write-up must be placed in the Physics & Astronomy Library; there you can find examples of successfully completed MSI projects to serve as format and style guides for your own work.

Course Curriculum

The curriculum depends on the student’s preparation, the nature of the instrumentation project. Here is a possible schedule for a student who does not need to take optional preparatory courses:

<table>
<thead>
<tr>
<th>M.S.I. Curriculum</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>PHYS 6610 Electronics I</td>
<td>PHYS 6620 Electronics II</td>
</tr>
<tr>
<td></td>
<td>PHYS 6750 Modern Optics I &amp; II</td>
<td>PHYS 6730 Computational Physics</td>
</tr>
<tr>
<td>Year 2</td>
<td>PHYS 5719 Lab Techniques</td>
<td>PHYS 6770 Optical Measurements</td>
</tr>
<tr>
<td></td>
<td>PHYS 6771 Ionizing Radiation</td>
<td>PHYS 6859 Instrumentation Project</td>
</tr>
</tbody>
</table>

Subsequent semesters, if necessary, would consist of PHYS 6859 Instrumentation Project research credits.

Summary of Administrative items

- Advising sessions (start of each semester, see Appendix A for more information)
- Form Supervisory Committee (see Appendix A for more information)
- Program of Study
- Instrumentation Project Proposal
- Apply for Graduation
- Final Presentation/Submit Report to Department
MASTER’S IN COMPUTATIONAL PHYSICS

3.5. PHYSICS M.S. WITH COMPUTATIONAL PHYSICS EMPHASIS

Overview
The Department of Physics & Astronomy offers a Computational Physics option under its regular M.S. program in cooperation with the Departments of Mathematics and Computer Science. This program is intended to equip students in science and engineering disciplines with modern computational skills for use in solving problems in the physical sciences. Degree requirements include classes in numerical analysis using networked Unix workstations in an X---window environment, physics core and specialty courses, and a computational physics project. The project may be developed in cooperation with a student’s employer or in conjunction with a University research group. A detailed project report is required. Electives include scientific visualization, architectures and algorithms, minicomputer interfacing with experimental apparatus, and case studies in computational engineering and science.

Faculty members of Physics & Astronomy available to supervise thesis research in this program include:

- Adam Bolton (astronomy; data mining, statistical analysis)
- Ben Bromley (astrophysics; planet formation and galactic dynamics simulations)
- Carleton DeTar (high---energy theory; lattice quantum chromodynamics [QCD])

This program is open to any student admitted to graduate studies in Physics & Astronomy.

Required Degree Elements

- Form Supervisory Committee
- Core Courses
  - PHYS 5010 Theoretical Mechanics & Quantum Mechanics (3 credit---hours)
  - PHYS 5020 Theoretical E&M and Statistical Mechanics (3)
  - PHYS 6720 Introduction to Computing in Physics (4)
  - PHYS 6730 Computational Physics (4)
- Specialization Course (minimum 3 credit---hours, 5000+ level)
- Computer Science Electives (minimum 6 credit---hours)
  - PHYS 6620 Data Acquisition for Scientific Instrumentation (4)
  - MATH 5660 Parallel Numerical Methods (3)
  - MATH 5740 Mathematical Modeling (3)
  - MATH 6790 Case Studies, Computational Engineering & Sciences (3)
  - MATH 6795 Seminar, Computational Engineering & Sciences (3)
  - CS 5010 Software Practice I (3)
  - CS 5020 Software Practice II (3)
  - CS 5630 Scientific Visualization (3)
  - CS 6210 Advanced Scientific Computing I (3)
- Program of Study Approval/Review of Proposed Project
- Research credits (PHYS 6970 Master’s Research, 6---10 credit---hours)
- Final Presentation and Written Report

Note: MATH 6795 is cross---listed with CS 6938
Description of Required Elements

Many elements of the MSI degree are the same as in the M.S. Physics program, such as the formation of the Supervisory Committee and Program of Study approval. There are differences, as we now describe.

- **Courses.** A total of 30 semester hours of credit are required to complete the program. Six to ten credit—hours will be related to the computational project. Well—prepared students may exchange PHYS 5010/5020 with electives or other courses as approved by their Supervisory Committee.

- **Computational Physics Project.** At the present time there is no formal project proposal that needs to be approved. However, we recommend that your Supervisory Committee review your proposed work before you begin your project.

- **Final presentation and Written Report.** A detailed project write—up is required for completion of the degree, and a final formal oral presentation to the Supervisory committee of the project may be required as well, at the Committee’s discretion.

Course Curriculum

The curriculum depends on the student’s preparation, the nature of the instrumentation project. Here is a possible schedule for a student who does not need to take optional preparatory courses:

<table>
<thead>
<tr>
<th>M.S. Comp. Phys.</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
</table>
| Year 1           | PHYS 6720 Intro to Computing  
PHYS 5010        | PHYS 6730 Computational Physics  
PHYS 5020        |                 |
| Year 2           | (specialization course)  
(elective)        | PHYS 6790 Research  
(elective)        |                 |

Subsequent semesters, if necessary, would consist of PHYS 6970 Computational Physics Project Research credits (PHYS 6790).

Summary of Administrative items

- Advising sessions (start of each semester, see Appendix A for more information)
- Form Supervisory Committee (see Appendix A for more information)
- Program of Study
- Apply for Graduation
- Final Presentation/Submit Project Report
4. ASSISTANTSHIPS AND FELLOWSHIPS

4.1. TEACHING ASSISTANTSHIPS, TEACHING FELLOWSHIPS, & RESEARCH ASSISTANTSHIPS

The Physics & Astronomy Department has a number of assistantships and fellowships available to graduate students. Awards will be made generally to graduate students in good standing who are making substantial progress toward their degrees. Eligibility for these awards is usually the same as eligibility for Tuition Benefits (Section 2.2). For example, you must maintain a cumulative GPA of at least 3.0, and that you register for 9---12 credit---hours of graduate---level courses (5000 or higher). Furthermore, if you are an international student seeking a teaching assistantship (ITA), then you will need to demonstrate spoken---English proficiency (e.g., TOEFL), as defined by the Grad School; see


The Department tries to support students financially as best it can through assistantships and fellowships. Typically Ph.D. students start off as teaching assistants (TA’s), and after they start in on their research projects, they become research assistants (RA’s), with funding arranged by their research advisor. In cases where advisors do not have grant support, students may continue to serve as TA’s if TA slots are available. Please bear in mind that there are also external sources of funding for graduate students, which sometimes come with extra resources for travel, as well as prestige.

In this section you will find a description of the Department’s assistantships and fellowships; Section 5 contains information on external funding sources. (Note: Here we often refer to students who need to demonstrate English proficiency. Recent Grad School admission requirements make these cases increasingly rare.)

**Teaching Assistantships**

These assistantships are awarded to students in good standing (i.e., eligible for Tuition Benefits) usually for a maximum of two years for Ph.D. candidates, and one year for Master’s degree candidates. To maintain support after this time limit, each semester the teaching assistant (TA) must have the chair of his or her Supervisory Committee write a letter to the Director of Graduate Studies requesting support, enumerating progress toward the degree during the previous semester.
The Department and University currently offer several types of teaching assistantships, varying by degree of experience of the TA and nature of the teaching assignment:

- **Level I TA or Graduate Assistant (GA).** This position offers a baseline in salary and level of responsibility; a TA at this level may cover grading, but not lab or discussion sections. The GA designation is typically used for students who have not yet demonstrated English proficiency.

- **Level II TA.** Students who perform well in teaching, demonstrate English proficiency (in cases of International TA’s), and have good academic standing in their graduate programs are encouraged to apply for a (Level II) TA position. Responsibilities of a Level II TA may include overseeing lab or discussion sections or serving as a Class Marshall (see below). Salary for this position will exceed that of the Level I TA by approximately 18%. To receive a Level II TA position you must apply, usually as part of your Graduate Admission application. Awards may be made throughout the academic year, although they are subject to revocation upon poor teaching or academic performance.

- **University TA (UTA).** Alternatively a more experienced TA may apply for a competitive University Teaching Assistantship through the Graduate School. For more information, see UTA application: [http://www.gradschool.utah.edu/tbp/finassist.php](http://www.gradschool.utah.edu/tbp/finassist.php)

**Teaching Fellowships**

Graduate students may apply for a selective Teaching Fellowship (TF), if they have passed the Common Examination, established a supervisory committee, demonstrated good teaching skills, and shown progress toward the degree. Applications are made with the help of the research advisor. The Teaching Fellowships may be renewed for a second year. Students receiving the stipend will be expected to perform teaching duties as with the teaching assistantship.

**Research Assistantships**

Faculty members often provide funding to students, usually (but not always) their advisees, to work on a research project. The arrangements for awarding and renewing a research assistantship (RA) are made directly with the professor who has the funding. Assistantships are typically given only to those students who have passed the Common Examination and have established a supervisory committee. The length of the research assistantship is an agreement between the student and the faculty member with the funding. There are award research fellowships available, too, such as the University’s GRF program:

University’s Award Fellowships: [http://www.gradschool.utah.edu/tbp/finassist.php#fellowships](http://www.gradschool.utah.edu/tbp/finassist.php#fellowships)

**Summer Assistantships**

A few summer teaching assistantships (Level II TA) are available and will be given to those students who best demonstrate good teaching skills.
**Evaluation Of Performance of GA's, TA's, and TF's**

The performance and progress of teaching fellows and teaching assistants will be reviewed annually. In addition to satisfactory performance of teaching duties, TF’s and TA’s should be making progress in their academic program, including (if applicable) English proficiency. If a student is not successful in these respects, the teaching assistantship may be terminated. If you find your assistantship to be at risk, contact your graduate advisor, who may help arrange for a continuation or reinstatement of an assistantship, conditional on improved academic or teaching performance. Be careful, though. If you fall out of Tuition Benefit Eligibility (e.g., GPA below 3.0), the Department may not be able to help, as there may be conflicts with Grad School regulations about TA support.

Occasionally the Physics & Astronomy Department may have teaching needs that will lead to the temporary waiving of the above rules. Usually this will only occur if the student has special teaching skills that are particularly needed. Also, a student’s supervisory committee may request that the Department waive these rules if some clearly special circumstances exist. Note that these waivers are rare, and never indicate a formal change in the rules.

### 4.2. Teaching Assistant Responsibilities

This section is intended to outline departmental procedures regarding Teaching and Graduate Assistants. It covers assignment procedures, job disciplines.

**Teaching Assignments & Loads**

A standard TA or GA load is 20 hours per week. TA’s and GA’s are typically awarded for two semesters and the load is maintained for two semesters. Enrollment contingencies may make it necessary to trade overloads in one semester for light loads in another. In other words, the standard TA/GA load is actually no more than 20 hours per week averaged over two semesters.

Some jobs are common enough to have pre-assigned hourly workloads, whereas some must be evaluated as they arise. The following is a table of typical pre-assigned workload values:

<table>
<thead>
<tr>
<th>Job (Fall/Spring)</th>
<th>Hours/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Discussion Sections 2010 or 2110 Series</td>
<td>20</td>
</tr>
<tr>
<td>2 Discussion Sections 2210 Series</td>
<td>20</td>
</tr>
<tr>
<td>1 Lab Section 2019, 2029 Series</td>
<td>7 (10 first semester teaching lab)</td>
</tr>
</tbody>
</table>

The above unit values are for Fall and Spring semesters. In the Summer semester, the typical values are:

<table>
<thead>
<tr>
<th>Job (Summer)</th>
<th>Hours/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Discussion Section 2010 or 2110 Series</td>
<td>10</td>
</tr>
<tr>
<td>Grading</td>
<td>(dependent on course level and enrollment)</td>
</tr>
</tbody>
</table>
The workload value for the other jobs is determined case by case. For example, a grader is assigned to any instructor of a class other than a discussion section whose enrollment warrants assistance, but the actual assignment may vary depending on whether the class is introductory (e.g., PHYS 1010) or advanced (such as PHYS 6720). Where possible, the workload is estimated with help from experienced TA’s who have previously read for a particular course. Note that the assignment is made on the basis of how long it should take, not how long it actually does take.

A few exceptional TA’s may be selected as course marshal for large courses (e.g., PHYS 2010). The marshal typically has reduced grading or discussion section workload, but has additional responsibility in terms of organizing the discussion section schedules of other TA’s for the course, arranging help sessions, and coordinating grading of homework and exams.

**Example Job Descriptions**

For the more common TA and grading assignments, we can list specific duties and necessary job qualifications.

**Instructors of Discussion Sections (2010, 2020, 2110, 2120, 2210, 2220)**

*The Job:* The Instructor meets with the discussion section twice weekly to provide help with assigned problems and with questions that arise concerning the course. He or she grades exams and helps proctor them. Attendance at lecture is required. Personal involvement with students (dating, tutoring for pay, etc.) in one’s discussion section is forbidden. Each instructor should schedule approximately three hours per week for consultation with students.

*Qualifications:* The Instructor must be able to speak English well, must have passed the SPEAK test, must be conscientious about preparing for class, must be reliable in attendance, and must be willing to help students on an individual basis where necessary. It is highly recommended that the TA attend the lecture (at least the first time through the course).

*Criteria for Assignment and Retention:* Student ratings on university or departmental evaluations and recommendation of the instructor in charge of the course form the basis for assignments and retention.

**Lab Instructors (2015, 2025, 2215, 2225)**

*The Job:* The class meets once a week, for a three-hour period of investigation in the laboratory. The instructor’s responsibilities in the laboratory are (a) to motivate the students towards independent thinking in applying physical principles to experimental problems; (b) to teach experimental techniques; (c) to instruct the students in the care and use of equipment; and (d) to solve simple malfunction problems with the equipment. The instructor is required to attend scheduled meetings of laboratory instructors and must become familiar with the equipment and the experimental procedures prior to the laboratory class. The instructor is to remain in the laboratory during the time the students are performing the experiments. In case an instructor is unable to attend class, he or she is expected to find an approved substitute. The instructor grades the students’ homework and lab reports and must keep a record of these grades.
Qualifications:
The instructor must be able to communicate effectively, must be conscientious in helping the students in both an individual and a group basis, and must have some prior knowledge of experimental equipment, experimental techniques and safety lab.

Criteria for Assignment and Retention: Student ratings on University and departmental evaluations and an appraisal by the laboratory supervisor concerning attitude, accomplishments, and ability form the basis for assignments and retention.

Graders

The Job: Graders are assigned to a lecturer (professor in charge of a course) to grade homework, quizzes, and/or exam. At the request of the lecturer, a grader answers student’s questions about problems.

Qualifications: Language fluency is less important in this job. The grader should have completed the next higher level course sequence (than the course being graded) with at least a B+ grade.

Criteria for Assignment and Retention: The recommendation of the lecturer provides the basis for assignments and retention.

The above job descriptions apply to Fall and Spring semesters. In Summer Semester, some of the discussion sections meet on a different schedule; thus the teaching loads are different. Information about loads is available at the time TA applications for Summer Semester are received.

Performance assessments

For the above assignments and others not listed, your performance will be evaluated. Personal observation by the instructor or other members of the Department, as well as comments from individual students, will be factors in assessing how well you are doing. If students fill out course evaluations for you, you may find them in the Physics & Astronomy Main Office (they are not publicly available).

If you or someone else determines that your TA or grading performance needs to improve, please make this an opportunity to go get help. Center for Teaching & Learning Excellence is a great place to start.

CTLE: www.ctle.utah.edu

(We all benefit from tuning up our teaching effectiveness, so please check out the site, no matter what!)

If students cannot or refuse to work on improving teaching skills, the Department may be unable to provide GA or TA support. Also, if a student is negligent in any way, for example failing to show up for an assignment/discussion section, then at very least a verbal or oral reprimand will be issued. More severe cases may require more severe action, including termination or non-renewal of assistantship. Such cases will be considered by the Department Policy Board, which will then take appropriate action.

Note that if a TA/RA is dismissed early in the semester, before earning $6k for the assignment, they may lose tuition benefits as well as a salary. For the University’s blanket policy on hiring/firing is in

University Policy 6---309: www.regulations.utah.edu/academics/6---309.html
4.3. TA Assignment Procedures & Considerations

Teaching assignments in the Physics & Astronomy Department typically fall into four main categories:

1. Discussion sections for large courses (2010, 2010, 2110, 2120, 2210 and 2220)
2. Upper level lab assistants (3410, 3610 and 3719)
3. Elementary lab assistants (1890, 2015, 2025, 2215 and 2222)
4. Grading for undergraduate courses

These assignments are listed in the order of communication skills required to fill the assignment. Discussion TA’s need the highest communication skill set since they have four hours of student contact each week. They need to be able to speak clearly, understand questions students ask, and explain physics problems with clarity and accuracy. TA’s for upper level lab courses require the same communication skills and need a deeper understanding of the course material. Elementary lab TA’s need a high level of communication skills, but typically meet students on a one-on-one basis. The ten-minute introduction requires good communication skills. Grading requires the least communication skills unless the instructor requires the TA to conduct a discussion section for the course.

There are many factors that go into making a TA assignment. Some of the most important issues are listed in approximately the order of importance:

- A list of possible TA’s is shown to the faculty members who will teach the large lecture courses, and the instructors are asked to give approval of the TA’s who are planned for the course. Faculty input is taken very seriously, and every attempt is made to make certain that faculty are happy with the list of TA’s. This is especially true when the marshal is being selected. (Most of the time the faculty member will request a specific marshal).
- The prospective discussion TA list is reviewed with staff members who have worked with the individual TA’s in prior semesters. This input is weighed and considered. Student evaluations of TA’s are reviewed to make certain all is in order.
- Many faculty have requests for specific graders, lab assistants, discussion leaders and marshals. These requests are factored in and granted when possible.
- New TA’s are surveyed during the orientation and asked to list the assignments they would prefer. These requests are granted when possible.
- Discussion assignments for the large lecture courses are made first, lab assistant assignments second, and finally grading assignments.
- There are always one or two special need assignments that require special considerations (3730 TA, one time course offering TA, etc.)
- Always at the last minute a TA will have an assignment and then finds and RA. This requires a reshuffling of assignments -- sometimes requiring extensive reassignments.
- TA performance will be considered in making TA assignments. Typically outstanding performance will most likely result in that TA becoming marshal in the near future. Bad performance should lead to dismissal but to this point in time has resulted in a reassignment of duties for future semesters.
- We will send out a notice to Tas for spring semester and fall semester to have respond and request the assignment they desire for that semester. These requests obviously cannot be guaranteed, however whenever possible they will be honored.
The goal we strive for with TA assignments are, in order of importance:

- The assignments are fair. Each TA should be given an assignment that requires approximately 20/week. This is spelled out on the final TA Assignment list, and the faculty know exactly how many hours each TA has been assigned.
- The assignments will provide the best instruction for the students. The students deserve the best TA’s we can provide in each position.
- Faculty are happy with the TA’s who have been assigned to them.
- TA ability a skill set is matched to the TA assignment
- TA’s feel they have been treated fairly.

In order to achieve these goals there has always been fine tuning in the assignments after the first list is distributed. A sheet listing the assignments is sent to all TAs with a note telling them to contact the person making the assignments if there is a problem. Faculty or TA In marshals often give input that additional help is needed or that a certain TA needs to be shifted to another assignment, etc.

4.4. SUMMARY ITEMS FOR TA’S

We close this section with a final summarizing list relevant to Teaching assistantships:

- Level I TA’s are not given responsibility in the labs or discussions. These students have not passed the Versant Spoken Language Test requirements imposed by the University of Utah.
- Level II TA’s are given any assignment since they have passed the Versant Spoken Language Test. They are paid at a higher rate. These are the only students considered for a summer TA since the summer assignments are so scarce and limited.
- A full TA for 20 hours/week is normally one of the following
  - 2 discussion sections
  - 3 labs (2 the first time teaching labs)
  - Grading 1 or 2 courses depending on enrollment & how the instructor uses the grader.
  - Miscellaneous (rare) special assignments.
- The minimum requirement for graduate students to get a TA after being one for two or more years is a letter from the chair of his/her Supervisory Committee to the DoGS or Department Chair. The letter must certify that the student is making satisfactory progress toward the degree, explain why there is no funding for RA, support and provide the expected date of graduation.
5. GRADUATE STUDENT RESOURCES

Here we cover some academic and non---academic issues that may be of broad concern as your graduate career progresses, such as how to look out for your overall well---being, among many other things.

5.1. INTERNATIONAL STUDENT INFORMATION

If you are an international student, you may have a whole level of bureaucracy (ICE) to do deal with that has little to do with your degree, and everything to do with your ability to attain it. The International Center provides resources here at the University to help with a variety of issues, especially with regard to your visa. The Center’s website is

International Center: http://ic.utah.edu

Visa Issues. Unfortunately, visa troubles sometimes occur and when they do they are painful. So please be careful with arranging for a Leave of Absence, or Continuous Minimum Registration. Also, if for any reason you need to go abroad in the middle of a semester while you are on a TA or RA, make arrangements in case you are prevented from re---entering the country. You may lose Tuition Benefits and get charged for tuition, among other things. Just plan ahead. Here is a place to start:

IC’s F---1 Visa Status: http://www.ic.utah.edu/students/current/maintainingStatus.htm

English proficiency. Finally, international students who are not native English speakers must be cleared by the International Teaching Assistant (ITA) program in order to be given a TA.

International TA Program: http://www.gradschool.utah.edu/ita

If English fluency is a problem for students, then they will be encouraged to get some assistance, through ESL classes, for example. The International Center can help.
5.2. Disability Services: Making the Program Work for You

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 has compiled an excellent list of resources, available through this link:

  Center for Disability Services: http://disability.utah.edu

5.3. Maintaining Your Well-being: Health and Counseling Resources

Graduate school is notoriously stressful. Here are some ideas and resources available to you so that your grad school experience is broadly rewarding.

- **Be part of the Community.** Life as a grad student is more than coursework and research, but making it fulfilling may seem difficult, especially if you do not have family here. Fortunately there are many opportunities to meet people and to enjoy varied activities in Salt Lake City. To start, try the Physics and Astronomy Graduate Student Advisory Committee. They may provide excellent ideas. (You might become an active member!):

  Graduate Student Advisory Committee: http://www.physics.utah.edu/~gsac

- **Health issues.** For most of us, access to health care requires health insurance. Fortunately you can get subsidized health insurance through a program administered by the Graduate School. Another important resource is the Student Health Center, where you can receive a variety of services including vaccines, diagnostic testing/screening, and counseling.

- **Stress management and counseling.** If you need help with stress, anxiety, depression or mood swings, or if you and your partner could benefit from talking together with a counselor, then call or visit the Counseling Center. The services are comprehensive, excellent and extremely inexpensive. **HIGHLY RECOMMENDED for all University students and employees.**

- **Substance Abuse.** There are many resources available to help with addiction and alcoholism. The Student Wellness Center provides some on-line links, and both the Student Health Center and Counseling Center can help more directly.

- **Use all available resources.** On-campus providers can guide you to more comprehensive treatment and recovery services off-campus.

**Links to campus health and wellness resources:**

  Counseling Center: http://www.sa.utah.edu/counsel/
  Subsidized Student Insurance: http://www.gradschool.utah.edu/tbp/insurance.php
  Student Health Center: http://www.studenthealth.utah.edu/
  Student Wellness Center: http://www.wellness.utah.edu
The atmosphere in the Department of Physics and Astronomy is generally professional, yet very friendly and supportive. Students in our graduate program tend to have a positive “we’re in this together” attitude toward meeting the challenges of coursework, research, and being a TA. Like the faculty students are required to maintain high ethical standards and to treat others with respect. In this section we discuss these issues, as well as what happens when conflict arises, perhaps because of a failure to show respect.

- **Student Rights and Responsibilities.** The University has outlined its policy regarding your conduct as a graduate student:

  Student code: [http://www.regulations.utah.edu/academics/6---400.html](http://www.regulations.utah.edu/academics/6---400.html)

  The bottom line is that we are in a place of learning and we shall help, not impede, our own or others’ pursuit of knowledge (do not plagiarize, cheat or interfere with other’s studies). If you do your part we will try our best to support your effort. If you do not, you may be required to leave our University.

- **Conflict resolution.** We hope that the Department of Physics and Astronomy is free of conflict. However, in case you are in a situation where a dispute arises, we want to provide you with options.

  - **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 (1---5801).

  - **Sexual Harassment or discrimination.** In cases of sexual harassment or discrimination of any sort, we ask that you contact the OEO (Office of Equal Opportunity; 801---581---8365), even if you are in doubt. We can help you contact OEO if that would help.

  - **Conflict between students or a student and a faculty member.** If a conflict arises, perhaps because of unprofessional behavior it may help to talk with the person with whom you are in conflict. Otherwise talk with your advisor, the DoGS, or the Department Chair. If possible we will try to resolve the situation, typically by mediation. If we cannot help, the Dean of Students Office is the best resource.

  - **Academic disputes and appeals.** For academic disputes such as contested grades, cheating accusations or publication authorship, for example, the DoGS or Chair can help. Further appeals go to the Associate Dean of Student Affairs in the College of Science.

- **Conflict resolution options**

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<tr>
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<td>Discussion between parties</td>
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<tr>
<td>Other conflicts</td>
<td>Meet with Chair or DoGS to mediate</td>
<td></td>
</tr>
<tr>
<td>---Discrimination</td>
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<td>---Personal conduct issues</td>
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<tr>
<td>---Academic dispute</td>
<td>College of Sci., Assoc. Dean, Student Affairs</td>
<td>801---581---6232</td>
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</tbody>
</table>
5.5. Beyond Classes: Other Educational Opportunities

You will start off taking courses, but it is important to explore other education possibilities as well. One practical reason is that the tuition benefits program is generous, but it does limit your time here. It is best to find a research project quickly. You will want to get as much information as you can about your options. Take part in the Graduate Student Symposium, the Condensed Matter Seminars, the BOWTIE seminar (astronomy/astrophysics), and especially the Department Colloquium to learn about your research possibilities. (Note: You may be required to attend the Colloquium.) Talk with other graduate students. Do not limit yourself to the Department; there are research groups in Scientific Computing Institute and the Department of Radiology, for example, in which our students have worked.

Another possibility is to attend conferences. Often you will participate in professional meetings with your advisor, but do not wait for an invitation. Often meeting organizers can provide some travel money for graduate students. If you are well into your research, definitely present a poster or (better) give a talk. Just for example, some good local meetings include:

- APS Four---Corners Section Meeting: [http://www.aps.org/units/4cs](http://www.aps.org/units/4cs)

5.6. Online Resources for Graduate Study and Beyond

--- OR ---

How to Get Funding, Write a Thesis, and More

This section lists some websites that may contain useful information for you. However, first you must get on---line. As a graduate student, you will be given an account on our Department’s computer system. We have terminals available for use in all of our campus buildings (INSCC, JFB, SP). To apply for an account, ask at the Physics & Astronomy front desk.

The sites provided here are the “tip of the iceberg” of on---line resources for grad students. We will try to give just some basics. Try the Department website for more, especially those sites related to fellowships. You should apply, even if your advisor has funding for your research, since many fellowships carry prestige.

**Graduate School and University sites that you should know about**

- Grad School Home: [http://www.gradschool.utah.edu](http://www.gradschool.utah.edu)
- Graduate Catalog (requirements): [http://www.gradschool.utah.edu/catalog](http://www.gradschool.utah.edu/catalog)
- International TA program: [http://www.gradschool.utah.edu/ita](http://www.gradschool.utah.edu/ita)
- International Center: [http://ic.utah.edu](http://ic.utah.edu)
- Marriott Library: [http://www.lib.utah.edu](http://www.lib.utah.edu)
- Student Resources: [http://www.gradschool.utah.edu/students](http://www.gradschool.utah.edu/students)
- Tuition Benefits Program/Insurance: [http://www.gradschool.utah.edu/tbp](http://www.gradschool.utah.edu/tbp)

**Your Rights and Responsibilities**

- Student Code: [http://www.regulations.utah.edu/academics/6---400.html](http://www.regulations.utah.edu/academics/6---400.html)
**Funding opportunities for grad school** (There are more! Ask your advisor...)

- University of Utah Fellowships: [http://www.gradschool.utah.edu/tbp/finassist.php#fellowships](http://www.gradschool.utah.edu/tbp/finassist.php#fellowships)
- NASA GSRP Fellowships: [http://fellowships.hq.nasa.gov/gsrp/nav/](http://fellowships.hq.nasa.gov/gsrp/nav/)
- PhDs.org’s fellowship list: [http://jobs.phds.org/physics---jobs/graduate](http://jobs.phds.org/physics---jobs/graduate)

**How to write a thesis**


Dissertation Bootcamp was started in 2010 and the demand is extraordinarily high. Check it out, and sign up, if it seems helpful. Also, let the DoGS know what you think!

**Teaching resources**

- TA Resource Center: [http://web.utah.edu/taresources](http://web.utah.edu/taresources)
- Center for Teaching & Learning Excellence: [http://www.ctle.utah.edu](http://www.ctle.utah.edu)

(The CTLE really is excellent.)

**Computing resources**

- Utah Center for High Performance Computing: [http://www.chpc.utah.edu](http://www.chpc.utah.edu)

**Professional Organizations**

- American Institute of Physics: [http://www.aip.org](http://www.aip.org)
- American Physical Society: [http://aps.org](http://aps.org)

**Find a job in Physics and Astronomy**

- AAS’s Job Register for astro---ph: [http://members.aas.org/JobReg/JobRegister.cfm](http://members.aas.org/JobReg/JobRegister.cfm)
- PhDs.org’s jobs resources: [http://jobs.phds.org/physics---jobs](http://jobs.phds.org/physics---jobs)

Almost every astronomy or astrophysics faculty member got a position here in Utah through the AAS Job Register. Almost every physics faculty member found his/her position here through APS’s Physics Today.
5.7. Off-line resources: Things to do for fun.

Salt Lake City, Utah, and the University of Utah in particular offer many opportunities for enjoying breaks from your studies. Word-of-mouth is a good way to find fun things to do. The University always has interesting events as well:

U of U events calendar: [http://www.events.utah.edu/](http://www.events.utah.edu/)

Meanwhile, for your amusement only, here is a to-do list while you are in Salt Lake City. (The Department’s virtual legal squad has not approved of all of these items. They do not constitute an endorsement of any kind. This list is NOT an implicit recommendation that you should ever be away from your lab bench or computer workstation.)

- Look at stars from the South Physics Observatory
- Go to a play at the Pioneer Theatre
- Volunteer as a science fair judge ([http://www.slvsef.org](http://www.slvsef.org))
- Swim in the Great Salt Lake. Or at least smell it.
- See a concert at Kingsbury Hall
- BORSCH (Bike, Overnight [camp], Run, Ski, Climb, Hike); we are less than a half-day’s drive from Grand Canyon, Yellowstone, Bryce, Zion, Canyonlands, Arches, Capitol Reef...
- Check out the Sundance Film Festival
- Take a Gallery Stroll downtown (third Friday of each month, 6pm)
- Do something cool and have the DoGS add it to this list!
6. SUPPLEMENTAL DEPARTMENT INFORMATION

6.1. GRADUATE COURSES IN PHYSICS AND ASTRONOMY

**PHYSICS**

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<td>5015</td>
<td>Observational Methods and Data Analysis</td>
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<td>7970</td>
<td>Thesis Research: Ph.D.</td>
</tr>
<tr>
<td>7980</td>
<td>Faculty Consultation</td>
</tr>
<tr>
<td>7990</td>
<td>Continuing Registration: Ph.D.</td>
</tr>
</tbody>
</table>

**ASTRONOMY**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>5015</td>
<td>Observational Methods and Data Analysis</td>
</tr>
<tr>
<td>5570</td>
<td>Galactic Astronomy &amp; Stellar Populations</td>
</tr>
<tr>
<td>5580</td>
<td>Extragalactic Astronomy and Cosmology</td>
</tr>
<tr>
<td>5590</td>
<td>Stellar Astrophysics and Compact Objects</td>
</tr>
<tr>
<td>6410</td>
<td>Intro to Research in Astron. &amp; Astrophys.</td>
</tr>
<tr>
<td>7730</td>
<td>Computational and Statistical Methods</td>
</tr>
</tbody>
</table>
6.2. Faculty Research

Ailion, David — Atomic Physics, NMR.
Bergman, Douglas — Cosmic rays.
Boehme, Christoph (Assoc. Chair) — Condensed matter, spectroscopy and spintronics
Bolton, Adam — Astronomy, observational cosmology and galaxy evolution
Bromley, Ben — Computational astrophysics, planet formation, galactic dynamics
Dawson, Kyle — Astronomy, observational cosmology, instrumentation
DeTar, Carleton — High-energy theory, computational physics, lattice QCD
Deemyad, Shanti — Condensed matter (experiment), high pressure phenomena
Efros, Alexei — Condensed matter (theory), disordered systems, left-handed materials
Gerton, Jordan — Nanoscience, Biophysics, near-field optical microscopy
Gondolo, Paolo — Theoretical astrophysics, dark matter, dark stars, cosmology
Harris, Frank — Chemical physics, atomic physics
Ivans, Inese — Astronomy, Galactic archaeology and stellar populations
Jui, Charlie — Cosmic rays
Kieda, David (Chair) — High-energy astrophysics, $\gamma$-ray astronomy, AGN variability
LeBohec, Stephan — High-energy astrophysics, $\gamma$-ray astronomy, optical intensity interferometry
Mishchenko, Eugene — Condensed matter (theory), 2-d spin polarized transport, graphene
Raikh, Mikhail — Condensed matter (theory), disordered systems, quantum Hall effect
Rogachev, Andrey — Condensed matter (exp’t), electron transport, superconductivity
Saam, Brian — Atomic physics, biophysics, MRI, hyperpolarized Xe
Saffarian, Saveez — Biophysics, enveloped virus budding
Sandick, Pearl — High-energy theory, LHC phenomenology, dark matter
Seth, Anil — Astronomy, star clusters, galactic nuclei and black holes
Sokolsky, Pierre (Dean, Science) — Cosmic rays
Springer, Wayne — Astroparticle physics, cosmic ray, (W. E. Observatory Director)
Starykh, Oleg — Condensed matter (theory), strongly correlated systems, frustrated magnetism
Symko, Orest — Condensed matter (experiment), superconductivity, thermoacoustics
Thomson, Gordon (Keuffel Chair) — Cosmic rays
Vardeny, Valy — Experimental physics, organic semiconductors, random lasers
Vershinin, Michael — Biophysics, nanoscience, optical trapping, emergent complexity
Wik, Daniel — X-ray astronomy, galaxy clusters, galaxies, black holes, cosmology
Williams, Clayton — Applied physics, atomic force and scanning tunneling microscopy,
Wu, Yong-Shi — High-energy theory, condensed matter physics, string theory
Zasowski, Gail — Astronomy, Galactic archaeology, Stellar Populations, The interstellar medium
Zheng, Zheng — Theoretical astrophysics, cosmology, galaxy evolution and clustering

(http://www.physics.utah.edu/people/faculty.html)
Appendix A.1. Formation and Operation of Graduate Student Supervisory Committees

Formation of Graduate Student Supervisory Committees

• The graduate advising committee will assign incoming graduate students a 3-member core supervisory committee prior to the beginning of their first semester. Each core supervisory committee member must be a tenure-line faculty member of the Department of Physics and Astronomy. The chair of this core supervisory committee assumes the role of academic advisor. The core supervisory committee would serve as the supervisory committee of a non-thesis Master’s degree student.

• If the student is pursuing a PhD or Masters with a thesis, at the time the student identifies their research topic and research advisor, the student should, as appropriate, change the composition of the supervisory committee to include the research advisor. A PhD supervisory committee must expand to have five members, the majority of whom must be tenure-line faculty in the Department of Physics and Astronomy. One of the members of a PhD supervisory committee must be from another department. The student may also choose to replace one or more of the members of the core supervisory committee. The research advisor must be a tenure-line or research faculty member from inside or outside of the Department of Physics and Astronomy. The composition of the PhD supervisory committee should represent both theoretical and experimental physics research groups. The chair, usually also the research advisor, must be a tenure-line faculty member in the Department of Physics and Astronomy.

• Any subsequent changes to the composition of the supervisory committee must be done in consultation with the student and all members of the supervisory committee and approved by the Director of Graduate Studies.

Operation of the Graduate Student Supervisory Committees

• Meetings with at least three members of the full supervisory committee, including the research advisor, must take place at least twice per year (once in each of the two academic semesters). The program of study meeting, qualifying exam, and PhD or Master’s defense fulfill this requirement.

• The agenda for each meeting should include the status, milestones, and schedule to completion of degree requirements, including coursework and research activities, as well as post-graduation employment plans. The committee should also provide guidance to assist the student with administrative and academic issues. The student is encouraged to report any difficulties impeding their academic progress to the advisor or any member of the supervisory committee as soon as possible.

• Once the student has chosen a research advisor: During each meeting, there must be a time when the student is excused to allow the committee members to discuss the student’s progress. There must also be a time when the research advisor is excused to allow the student to apprise the committee of any difficulties within their research environment. If a substantive dispute arises, the committee may refer to an ombudsperson or the department chair to assist with the resolution.

• Each meeting must be documented by one of the committee members. Once the student has chosen a research advisor, this documentation must include the content of the discussion in the event that either the research advisor or student reports anything during the portion of the meeting where the other is excused. These notes must be approved by all present committee members, sent to absent committee members, and filed with the graduate secretary before December 31st and May 31st for the fall and spring semesters, respectively. It is the responsibility of the DoGS to investigate should a semester pass without documentation of a meeting.

• Students must meet with their advisor to sign administrative forms and discuss financial support at the beginning of each semester. Once a research group is chosen, if funding for RA support for the student is not available, the research advisor should request TA support from the department in writing. If this meeting is independent of the meeting of the supervisory committee (which it may or may not be), the committee must be updated on the administrative matters and plans for the semester via email, with the graduate secretary copied in correspondence.
Appendix A.2. Graduate Advising Checklist (Ph.D. Physics)

Purpose: To provide a guide for an advising session between a grad student and the assigned Graduate Advisor or the student’s Supervisory Committee Chair (usually the thesis advisor). Students in Chemical Physics, Medical Physics, Astronomy, Biophysics or Master’s programs should meet with an advisor related to their program. Students who have begun thesis research should meet with their Supervisory Committee Chair. *This checklist is informal; Krista has the official version, which you and your advisor must complete for you to receive Tuition Benefits.*

1. **Review Common Exam status.** Has student passed? If not, what preparatory courses are necessary? (Recommendation: use Alternate Curriculum in the Graduate Handbook, Section 3.)

2. **Review courses already completed.** Have core courses been taken? Has student received a B or better (required for graduate credit) for all courses?

   - [ ] PHYS 7110, Class. Mech./E&M I
   - [ ] PHYS 7220, Quantum Theory I
   - [ ] PHYS 7310, Stat. Mech
   - [ ] PHYS 7740, Math Methods I
   - [ ] PHYS 7120, E&M II
   - [ ] PHYS 7230, Quantum Theory II
   - [ ] PHYS 6719, Grad Lab
   - [ ] PHYS 7800/7810 Colloquium/Seminar*   

   *Colloquium attendance is required for first 6 semesters and encouraged thereafter. If schedule permits, take PHYS 7800 for 2 credit--hours, otherwise take 7810 for 1 credit---hour. Even if neither 7800 or 7810 are taken, attendance will be monitored.

3. **Determine courses for this semester.** Consider long-term goals as well as degree requirements. Note that for tuition benefits eligibility, the total number of credit-hours is 9---12 (TA’s) or 9---11 (RA’s). **If a student is on the astronomy track, please refer her/him to an astronomy faculty for advice.**

4. **Discuss long-term plans for coursework and research.** If a student has not chosen a research area, identify areas of interest and (e.g.) plan to meet with faculty working in those areas.

5. **Ensure student is on track with the degree requirements.** This list is for Ph.D., up to thesis defense:

   - [ ] Common Exam
   - [ ] Core Courses
   - [ ] Elective outside of specialization
   - [ ] Form Supervisory Committee (by 2nd yr)
   - [ ] Program of Study (w/your Committee)
   - [ ] Qualifying Exam (by 3rd year)
   - [ ] Milestone Master’s (recommended)*
   - [ ] Apply for Graduation**

   *Milestone M.S. can be conferred after Qualifier is passed.
   **Application for Graduation is a University formality submitted the academic year of graduation; please see Krista Perkins.

6. **Review Tuition Benefit Program eligibility (if applicable).**

   - [ ] Cumulative GPA of 3.0 or above
   - [ ] Within allowed number of supported semesters*
   - [ ] Registered for 9---12 credit---hours (TA) or 9---11 credit---hours (RA)
   - [ ] TA/RA assignment is appropriate

   *4 semesters for M.S.; 8 for Ph.D. with prior M.S.; 10 for Ph.D. (no M.S.); add 2 semesters if student is/was TA for 2 years.

7. **Sign and submit Tuition Benefits Form and Graduate Advising Record** IF eligibility requirements are met and IF there is an agreement on course selection. Otherwise, please see the Chair of the Graduate Advising Committee.
Appendix A.3. Graduate Advising Record

This form serves as a guide for advising discussions, a formal record of what was discussed, and documentation that the advising requirement for the semester has been met. Please attach additional comments, if necessary. A minimum of four signatures are required, including the student and committee chair. Please complete and email/scan to committee members and Krista Perkins at krista@physics.utah.edu.

Student’s Name: _____________________  Next Milestone: _____________________
Current Semester: ( spring / fall ) 20___  Expected Graduation Date: ____________
Year in Program: ( 1 2 3 4 5 6 7 8+* )

* If 8+, is a Time Limit Exception Letter and Plan are in place?  □ Yes  □ No

Summary of Discussions

Coursework:

Research:

Financial Support/Tuition Benefits:

Career Plans:

Administrative/Academic/Other Issues:

Closed Sessions

Did a discussion with Advisor (student absent) take place?  □ Yes  □ No
Did a discussion with Student (advisor absent) take place?  □ Yes  □ No
Shared, open comments from these sessions:

**Please contact Krista if any type of follow-up meeting (e.g.: committee, DoGS, Chair, etc.) would be beneficial.

Signatures

Student: ______________________________  Chair: ______________________________
Member: ______________________________  Member: ______________________________
Member: ______________________________  Member: ______________________________
Appendix B. Graduate Lab Course Criteria

The Department of Physics and Astronomy has a Graduate Laboratory Requirement for several of its degree programs (e.g., Ph.D. in Physics). This requirement ensures that students have experience with experimental or observational data. One course, PHYS 6719, satisfies this requirement. However, under some circumstances, a student and her/his supervisory committee may find it beneficial to take a different course (3---4 credit---hours), perhaps more directly relevant to the student’s thesis research. Such a substitution for PHYS 6719 is justified if the substitute course contains the following curriculum items:

a. Counting and statistics; statistical distributions.
b. Error analysis and propagation.
c. Noise, noise sources, and signal averaging.
d. Fitting data to models, interpreting significance of results.
e. Execution of at least two experimental or observational projects incorporating the above concepts, and some sort of write---up.
f. Oral presentation (e.g. APS meeting---style) of work done.

A list of equivalent courses includes PHYS 6770/6775 (both lecture and lab components), ASTR 5015, ASTR 6410, ASTR/PHYS 7730, and the MRI Lab taught by Prof. E.K. Jeong.

NOTE: Your Thesis Supervisory Committee ultimately must approve your program of study. It is safest, therefore, to confirm with your Committee that your choice of Grad Lab substitute course is appropriate for your area of specialization.
Appendix C. Proposed Degree Specialization/Emphasis Requirements

This part of the handbook is reserved for new programs in the pre-approval stage, so that you can see what may be available to you down the road. [Coming soon: Biophysics Emphasis?]