

# **GRADUATE PHYSICS AND ASTRONOMY**

## **AT BYU**

### **A Handbook for Graduate Students**

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## 1. Welcome

Dear Graduate Student:

We are pleased that you have chosen Brigham Young University as the place to pursue your graduate education. When you complete your degree, you will be well prepared to meet the challenges that go with being a professional physicist.

We will assist you to be successful in every way that we can. We provide laboratory space to carry out research, instruments and supplies, and a professional faculty and staff available to teach and support you in every necessary way. We also provide qualified students tuition scholarships and teaching or research assistantships. We make a substantial investment in you.

We hope you will approach your graduate studies in a professional way. Graduate school is not a job, but you are subsidized to complete a degree. The department's contribution to your education is significant and our expectation is a serious commitment from you. The graduate student who looks upon their responsibilities as a 40 hour a week job has a mistaken understanding of the purpose of graduate study. Graduate students must be committed to their education which means expending all necessary efforts and spending the required time to further their own education. This will include coursework and research. If you have a teaching assistantship, you will need to divide your time with teaching responsibilities as well. This may require arriving early and working late, and often coming back in the evenings and on Saturdays (but not Sundays). Of course, you will also want to spend time with family and friends and in personal service and spiritual growth. To this end you must use judgment and planning in order to balance all aspects of being a graduate student.

The rewards that go with the successful completion of a graduate degree are great. We wish you success in meeting this goal.

Richard Vanfleet, Chair  
Department of Physics and Astronomy

## 2. General Information

This handbook is intended to provide basic information about the requirements and policies for graduate study in the Department of Physics and Astronomy. While there will be some overlap, it is not intended to supersede the material in the Brigham Young University Graduate Catalog <http://gradstudies.byu.edu/section/current>. Requirements necessary to complete the program will be found in both places and students should be familiar with both documents. Most questions can be answered by a careful perusal of these materials. This handbook will be updated as the need requires. Additional information can be provided by graduate advisors, the graduate secretary and department office as well as the graduate coordinator.

Upon admission to the program, every new student is assigned a faculty member as an initial advisor. This initial advisor will often not continue as the research advisor or as the chair of the student's graduate committee, but this person can be a useful resource, particularly in the first several weeks of a graduate program. This initial advisor can help orient the student in the department, assist with regards to registration details and introduce students to other faculty and help identify possible faculty research advisors in the student's area(s) of interest.

International students must often meet certain additional requirements associated with visas, permission to work and related issues. It is crucial that international students contact and visit the International Students Office (1351 WSC, telephone 422-2695) immediately upon arriving on campus for additional information and policies.

### 2.1 Departmental Expectations

The Department of Physics and Astronomy is committed to the success of all admitted students. To this end, the department provides all progressing students [teaching](#) or [research](#) assistantships, laboratory space, instruments and supplies, and the support of [faculty and staff](#). This support is to enable students to successfully complete degrees in a timely manner. Because graduate education is heavily subsidized, a serious commitment to coursework and research is expected in return. If students perceive graduate student responsibilities as an eight-to-five job for five days a week, they have a fundamentally mistaken understanding of the purpose of graduate education. It is not unreasonable for graduate students to spend fifty to sixty hours per week in the laboratory, in the library, or at the computer engaged in coursework or research. In addition, those with [teaching assistantships](#) will need to divide their time between teaching, research, and coursework, with the overall commitment being the same. This will mean arriving early and working late, and often returning to work in the evenings and on Saturdays. (At BYU we will understand, even expect, that students reserve Sundays as a day of rest.)

Of course, students must use judgment and spend a proper amount of time with family and friends. However, extended holidays and breaks between semesters are valuable opportunities to accomplish important work with minimal interruption. Graduate school should be recognized as a time of sacrifice. However, the rewards that can accompany the successful completion of a graduate degree can be both significant and rewarding.

#### *Good Standing*

To be a student in good standing, ongoing progress must be made in coursework, in research and in the student's development as a professional physicist or astronomer. This will be determined by the faculty advisor, classroom instructors, the graduate committee and the department. Graduate

student evaluations occur each semester and a rating is provided. The three possible ratings are satisfactory, marginal and unsatisfactory. Related considerations in these evaluations will include any assignments as a teaching assistant (TA) and the student's collegiality and contributions as a department citizen.

If it is determined that a student is not in good standing, their academic performance will be reported to [BYU Graduate Studies](#) as marginal or unsatisfactory, and the student will be notified in writing. The student will be expected to meet with their advisor to draft a plan to return to good standing. Subsequent failure to be removed from marginal or unsatisfactory status within one semester will cause the student's performance to be rated as unsatisfactory and may result in dismissal from the program or the withdrawal of departmental [financial support](#).

### *Citizenship*

Good citizenship in the department is not necessarily defined by a specific set of requirements but is certainly associated with the pursuit of academic excellence -- both the student's and their colleagues. Each student's ultimate career and professional success will depend on more than their technical achievements. To that end, students should take advantage of their time in graduate school to develop good interpersonal skills and the ability to work well within a group of other scientists and researchers.

At a minimum, each student will be expected to treat everyone with civility and consideration in the classroom, in the lab and in social settings. This includes showing respect to students they may interact with in the tutorial lab, as an instructor, or as a grader. Graduate students should avoid even the appearance of a condescending attitude towards undergraduates or other graduate students. Doing so will enhance the learning experience for all involved and demonstrate, in part, the student's commitment to academic excellence.

### *Communicating with the Department*

As necessary, the department will communicate with each student via an assigned mailbox in the physics office (room N283 ESC), a local address or through email. The information for the latter two should be on file with the university through myBYU and which the student must keep current.

## 2.2 Registration Requirements

In order to retain full-time student status, all graduate students should be registered every semester and term. In particular, students must register for and receive acceptable grades in at least six credit hours each academic year. Audited classes, independent study classes and courses offered through Salt Lake Center do not count towards the minimum registration requirement. Likewise, grades of D, E, W, and NS or incompletes (I grades) will not count as filling this university requirement.

A fairly standard academic year includes at least two credits in the fall semester, at least two credits during winter semester and at least one credit each during spring and summer terms. Exceptions must be approved by the graduate coordinator. Note that graduate students must register for at least two credit hours during the semester or term they intend to graduate, unless they intend to graduate in August (see graduate secretary for details).

If a graduate student does not meet the minimum registration requirements in any semester or term they will be dropped from the graduate program. This means that they will lose graduate student

status and must apply to resume graduate studies.

#### *Special requirements for international students*

International students must register for at least nine credit hours in both fall and winter semesters until coursework is completed and a Reduced Credit Load (RCL) designation is received. This is to fulfill U.S. Citizenship and Immigration Services (USCIS) requirements. If an international graduate student is registered for nine credits during both fall and winter semesters, they may not have to take courses during spring or summer terms as long as they are on their approved break. Once RCL designation has been granted, a student must still be registered for six credit hours each academic year. It is imperative that international students become informed about, keep abreast of, and follow these and other policies. Failure to follow these guidelines can result in the revocation of visas.

For questions beyond the information presented here, please see the graduate coordinator or the graduate secretary. Additional questions can and should also be directed to International Services ([iss.byu.edu](http://iss.byu.edu))

#### *Special requirements for students admitted mid-academic year*

If a graduate student is admitted to begin graduate studies in the middle of an academic year they must fulfill partial minimum registration requirements as listed below:

- Graduate students admitted to begin graduate study in the winter semester, are required to register for and receive acceptable grades for at least four credit hours over the remaining academic year (winter, spring, and summer).
- Graduate students admitted to begin graduate study in spring or summer terms are required to register for and receive acceptable grades in at least two credit hours for the term during which they are admitted to begin.

#### *Special requirements for students nearing graduation*

As a graduate student approaches graduation the student must ensure that they are registered for two credit hours during the semester or term they intend to graduate, unless they graduate in August.

## 2.3 Major Milestones and Degree Requirements

Making appropriate progress within the graduate program can be gauged, in part, by whether students are meeting major requirements in a timely manner.

The following is a brief description of the major milestones in roughly chronological order.

- **Enrollment:** In collaboration with the faculty advisor students will register for courses to meet the enrollment requirements discussed in section 2.2. Graduate students must earn a C- or better in all courses on the program of study.
- **Qualifying Exam:** Every graduate student must take the qualifying exam. All doctoral candidates and master's students planning on pursuing a doctoral degree must pass it. Every student has three chances to take and pass the exam. If a student does not pass after three attempts within 20 months of their admission into the program, they will not be allowed to continue in the doctoral program. Students pursuing a master's degree must take the qualifying exam for assessment purposes, but a passing grade is not required. The exam is normally offered every year just prior to the beginning of fall semester. Based on demand it

may also be offered at the beginning or end of winter semester.

- **Advisory Committee:** Every graduate student must have a graduate advisory committee. This will include an advisor (the chair of the committee) and a few other members. A master's committee will have at least three members while a doctoral committee will have at least five members. This committee is typically established during the student's first semester.
- **Program of Study:** Together with the advisor, the student chooses and takes a set of courses that will satisfy graduation requirements. This program of study must be approved by the graduate coordinator and submitted to the graduate secretary by the third week of the second semester for master's students and by the third week of the beginning of the second year for doctoral students.
- **Prospectus:** A prospectus is a student's research proposal as presented to the department. It describes a plan for the student's graduate research and its significance. The student provides a written document and gives an oral defense before their graduate advisory committee. The defense should be completed by the end of the second semester for master's students and by the end of the first year for doctoral students.
- **Candidacy Exam:** Doctoral students must pass the candidacy exam. This exam involves a presentation of completed research and expectations for ongoing work. It is both a follow up report to the prospectus defense and a demonstration of research competency and productivity. A written document (e.g. a published journal article) is presented and defended. This should be done within 12 months of the prospectus defense or by the start of the third year.
- **Writing a Thesis/Dissertation:** Every graduate student must write a thesis/dissertation that reports their graduate research. This will be the major written product meant to justify the graduate degree.
- **Defending a Thesis/Dissertation:** Once the thesis/dissertation has been approved, the student must defend it before an examining committee.
- **Applying for Graduation:** Graduate students must officially apply for graduation with the university. This is normally done early in the semester when the student plans to graduate. Delaying this application can result in unnecessary additional fees.

## 2.4 The Graduate Program of Study

Each graduate student, in consultation with their research advisor, develops a plan for their graduate experience and, in particular, for the physics and astronomy courses they intend to take. This list of intended courses is sometimes known as the "study list" or the graduate "program of study." It is intended to be adapted to meet the particular needs of each graduate student. All courses listed on the program of study must be successfully completed before the degree can be granted.

The program of study must be approved by the department graduate coordinator and should be submitted by the third week of the second semester for master's students and by the third week of the beginning of the second year for doctoral students. Failure to submit the program of study in a

timely manner may result in a registration hold being placed on your account.

Official submission of the program of study is done with form [ADV Form 3](#), “Program of Study,” which is available from the BYU Graduate Studies website and which should be filled out with the planned courses. It should be reviewed, approved, and signed by each member of the student’s graduate advisory committee together with the graduate coordinator and submitted to the graduate secretary.

It is possible (and common) to make changes to the program of study even after it has been submitted. Students can make changes by submitting [ADV Form 3b](#) the “Program of Study Change” form with all appropriate signatures again to the graduate secretary.

#### *Courses not on a Program of Study*

Students are welcome to take courses for their own benefit that are not on the program of study such as dance, choir, student activities, etc. after talking to their advisor. A student already taking a full load of approved courses for the semester (8.5 hours) or term (4.5 hours) may take additional courses for free. However, students must pay for any courses not on the program of study that are taken in a less than full load semester or term.

## 2.5 Evaluations

### *Informal Evaluations*

Towards the beginning of a graduate student’s time, they should expect to meet frequently with their advisor, at least weekly and perhaps more often. Over time, meetings may become less frequent as the student becomes more capable and comfortable with research. Such meetings will naturally constitute informal evaluations of a student’s work and progress.

### *Formal Evaluations*

Graduate students will be formally evaluated three times each year by the graduate advisor and/or graduate advisory committee. These evaluations are an opportunity to ensure that progress is consistent and satisfactory. A report of each evaluation will be submitted to BYU Graduate Studies.

Progress is rated as satisfactory, marginal, or unsatisfactory. Each category has a specific meaning:

- Satisfactory: A graduate student is on track in all things to successfully graduate within an acceptable time frame.
- Marginal: A graduate student is deficient in at least one or, possibly, several areas. Receiving a marginal designation effectively places the student on probation such that they have one semester to improve.
  - Examples of what can cause a marginal rating include but are not limited to:
    - Failure to submit a program of study by the deadlines.
    - Failure to establish a graduate advisory committee by the deadlines.
    - Registering for thesis hours but doing little or no work.
    - Failure to submit an approved thesis/dissertation prospectus within the approved time frame.
    - Minimal contact with the advisor or graduate advisory committee members.
- Unsatisfactory: A graduate student is in danger of being dropped from the program and will be dropped unless immediate action is taken.
  - Examples of what can cause an unsatisfactory evaluation include but are not limited

to:

- Earning an unacceptable grade in a program of study course.
- Failure to submit a program of study by the deadlines.
- Failure to establish a graduate advisory committee by the deadlines.
- Registering for thesis hours but doing little or no work.
- Failure to submit an approved thesis/dissertation prospectus within the approved time frame.
- Minimal contact with the advisor or graduate advisory committee members.
- Not progressing at a rate necessary to finish courses in a timely manner.
- Not meeting the requirements set forth in a previous marginal evaluation.
- Poor performance in research.
- Unethical behavior.

Two consecutive non-satisfactory (marginal or unsatisfactory) evaluations may result in termination from the program.

### *Remediation*

If a graduate student is determined to be making marginal or unsatisfactory progress that student will be informed in writing of the following:

- The specific work or tasks that needs to be done to make satisfactory progress.
- When each task needs to be accomplished
- What faculty member(s) the student should contact for more information or support.
- What will happen if these tasks are not accomplished (e.g., an unsatisfactory rating for the next semester or termination from the program)

Upon completing the requirements, the student's status may be restored to satisfactory.

## 2.6 Colloquia

All BYU Physics and Astronomy Department graduate students are expected to attend the weekly colloquium held every Monday at 4:00 PM during fall and winter semesters in room C215 ESC. Typically there is a guest speaker that will speak on their work, present results and share insights on current research in physics and astronomy. This is an excellent opportunity for graduate student to broaden their horizons and to learn new material both in and out of their own research subfields. Often, there are opportunities to visit and network with the speaker. Light refreshments are usually provided.

## 2.7 Student Research Conference

The department also participates in the Student Research Conference held on campus in March of each year. This is sponsored by the College of Physical and Mathematical Sciences and is a forum for students to give presentations regarding their research. All graduate students are expected to present at this local conference.

## 2.8 Time to Graduation

It is expected that a master's degree will take, on average, two to two and a half years. A doctoral degree will take, on average, four to five years. We recognize that delays may occur in some cases. BYU Graduate Studies allows eight years for the doctoral degree and five years for the master's

degree, thereby providing a two to three year cushion to allow for the unexpected. Nonetheless, an excessive amount of time to graduation reflects poorly on the student, the advisor, and the department. Students and faculty should not jeopardize the department's investment of time and resources by dragging out the time to graduation.

### 3. Master of Science Degree

#### 3.1 Degree Requirements

Graduate students must do the following to receive a master's degree:

- Take the [qualifying examination](#). A passing grade is not required.
- Complete 30 credit hours of coursework. This includes a minimum of 24 hours in approved courses and 6 hours of thesis work ([699R](#)).
- Create, with the help of the advisor and graduate advisory committee, a list of approved courses to be taken. This is the program of study and will include:
  - At least 18 hours must come from graduate courses (500 level or higher, but not Physics [691R](#), [696R](#), [697R](#), [699R](#) or [795R](#)).
  - Up to 6 hours can come from Physics [697R](#).
  - Up to 6 hours can come from BYU undergraduate courses (300 level or higher). If included, these courses must be approved by the student's graduate advisory committee and the graduate coordinator.
  - Complete Physics [696R](#) (Intro to Research) during each of the two initial semesters. This does not count toward the minimum of 24 hours of approved coursework.
  - Complete Physics [691R](#) (Colloquium) every semester in residence. This does not count toward the required credits.
- Maintain a minimum GPA of 3.0 with each course on the program of study passed with a grade of C- or better.
- Complete all coursework.
- Pass the [prospectus](#) examination.
- Complete and defend a thesis
- Complete all requirements above within five years of admission.

#### 3.2 The Graduate Advisory Committee

A graduate advisory committee is required for each graduate student. The master's graduate advisory committee consists of a chair (the student's advisor) and at least two other committee members. The chair should be a member of the Department of Physics and Astronomy. Committee members are usually from the Department of Physics and Astronomy though they may come from other departments as well.

The purpose of the graduate advisory committee is to:

- Assist in defining and directing a suitable research topic.
- Provide direction on appropriate courses to take and their sequence.
- Provide research guidance and mentoring. This is principally the role of the chair/advisor.
- Monitor research progress, including:
  - Approving the written prospectus and its defense.
  - Participating in annual progress evaluations
  - Ensuring active participation in a research group.
  - Approving the final thesis and its defense.

A graduate advisory committee is formally established on submission and approval of the [ADV Form 3](#), "Program of Study" form. This should be submitted to the graduate secretary and approved by the third week of the second semester. Changes to the graduate advisory committee

and the study list can be made by submitting [ADV Form 3b](#), “Program of Study Change”, to the graduate secretary. All changes should be made as early as possible in the program and with the consent of all committee members being affected.

### 3.3 The Prospectus

Each master's student must write and defend a prospectus by the end of their second semester. A prospectus is intended to be a proposal to the student's graduate advisory committee and to the department of the research that will be undertaken for the master's thesis. It is to explain the proposed research, the significance of that research and the resources needed to successfully accomplish the research. A good prospectus will include a well-defined research problem and a reasonable research methodology. It should persuade the graduate advisory committee that the proposed work is both feasible and appropriate in significance, approach and scope to qualify as master's level work.

The course, Introduction to Research (Physics 696R), is partially intended to help each student develop a prospectus. Nonetheless, the prospectus is largely written under the guidance of the research advisor. For regularly progressing master's students, the prospectus should be written and defended by the end of the second semester. Departmental research assistantships are awarded only following the successful completion of the prospectus defense.

LaTeX templates for prospectuses, theses and dissertations can be found at the [department website](#).

Once a prospectus is written, it must be defended to the advisor and the student's graduate advisory committee. This defense entails an oral presentation given by the student to the graduate advisory committee. The presentation should discuss the proposed research, including necessary background, the methodology to be used, required resources, and the significance of the research. Those present are welcome to ask a range of questions about the proposed research as well as questions that probe the breadth and depth of the student's understanding of the necessary background physics and astronomy. The graduate advisory committee makes a determination as to the quality of the written prospectus and oral presentation and the likelihood for success of the proposed research. Suggested modifications to the written prospectus may be made which the student should incorporate into the prospectus.

The following can be thought of as a rough sequence of events associated with the prospectus and its defense:

- Advisor and student agree on the written prospectus.
- Student arranges a date, time and place with the graduate advisory committee for a prospectus defense.
- Student schedules the defense with the graduate secretary.
- The defense is held.
- Student rewrites the prospectus addressing concerns and suggestions of members of the graduate advisory committee.
- Once approved by the graduate advisory committee, student secures signatures of the graduate advisory committee as well as the graduate coordinator.
- The approved prospectus is submitted to the department via the graduate secretary.

The approved version of the prospectus should be signed by the entire graduate advisory committee and by the graduate coordinator. The student should distribute copies of the prospectus

to the advisor and each committee member. An additional copy should be submitted to the department via the graduate secretary. The prospectus becomes a part of the student's permanent graduate record and may be used to judge progress in the program, as one input for further evaluations, and to keep track of research expectations.

Although the prospectus does constitute an agreement of sorts between the graduate student, the student's graduate advisory committee, and the Department of Physics and Astronomy on the nature and extent of the proposed research, it is possible that as the student's research develops emphases may change. It is the student's responsibility to make sure that all advisory committee members are kept current on the progress and possible changes in the direction of the research.

It is possible to change the composition of the student's graduate advisory committee after the acceptance of the prospectus. The new advisory committee members should be given a copy of the prospectus before they agree to serve on the committee. Should a research topic or methodology change significantly, or should a student change graduate advisors, the graduate coordinator will determine in consultation with the advisor and advisory committee whether the student will be required to submit and defend a new prospectus.

### 3.4 Graduation Application

Graduate students close to completion must apply for graduation through myBYU. This should be done early in the semester in which they plan to graduate. The deadline for this application can be found in the university calendar. Once an application is received, a review will be made of the student's graduation requirements. If any deficiencies are found, the faculty advisor and student will be notified. Applying for graduation is a prerequisite to scheduling the defense and being included on the official graduation list.

It is usually a good idea to apply before the deadline even if there is the possibility of a delay in graduation. If a student does not graduate during the originally intended semester, a deferral can be made to the next graduation opportunity.

### 3.5 The Master's Thesis and Final Defense

After having a prospectus approved, each graduate student will do the research. Upon completion of the work students present it in a final document, called the thesis, to the department. The nature of a thesis is as follows:

- It must contain a clear description of the aims and results of the research. It should provide sufficient introductory and background information to acquaint readers who are scientists but not experts in the field with the nature and importance of the work.
- It must follow the form and style as dictated by university and department requirements. Thesis style guidelines are available on the BYU Graduate Studies website under [ETD Instruction Packet](#).

Once the graduate advisory committee agrees that the thesis is in an acceptable form and is ready to be defended, a thesis defense can be scheduled. A time and place should be scheduled with the graduate secretary. This will include submitting the [ADV Form 8c](#), "Departmental Scheduling of Final Oral Examination," and obtaining the requisite signatures of the graduate advisory committee members and the graduate coordinator. Defenses may not be scheduled on holidays or University breaks. To ensure sufficient time for a thorough review of the thesis by the student's advisory

committee and the department, there must be at least two weeks between scheduling the defense and the date of the defense. The graduate student must provide each member of the advisory committee and the graduate coordinator with a copy of the thesis more than two weeks prior to the date of the examination. Under no circumstances will the advisory committee have less than two weeks to review the thesis.

The oral defense is open to the public. Students should consult with the chair of their graduate advisory committee to ascertain the format of the exam. Defending students may be asked to present a brief introductory overview of the research for the benefit of those not familiar with the work, and then present technical details at greater length. At the discretion of the graduate advisory committee chair, the public may be permitted to ask questions. At the conclusion of the presentation, the public will be excused and the graduate advisory committee may discuss with the student further technical issues, clarifications, or possible additional requirements. The graduate advisory committee then excuses the student and will decide on one of the following options:

- Pass
- Pass with qualifications: Student must complete minor revisions specified by the advisory committee. Once completed to the satisfaction of the advisory committee, the chair signs the appropriate paperwork for completion of qualifications.
- Recess: Student must retake the thesis defense from the same advisory committee no sooner than one month after the first exam. Only one recess will be granted to a candidate. The new exam must be formally scheduled with the university following the same procedure as before.
- Fail: The graduate degree program of the student is terminated.

After appropriate revisions of the thesis have been accepted and approved, the student submits their final thesis to the department and university. This is done by completing and obtaining signatures for [ADV Form 8d](#), “Approval for Final Dissertation or Thesis.” Subsequently, the graduate student will upload their thesis to the [ETD website](#) to receive department and college approval. Once the latter are granted the student submits [ADV Form 8d](#) to BYU Graduate Studies. Individual copies of the bound thesis can then be obtained from the department by contacting the graduate secretary.

### 3.6 Master’s Student Checklist

The following is a convenient summary of milestones and their corresponding deadlines that will need to be met by any master's student. It is not necessarily comprehensive, but does list the major requirements and milestones.

Milestone	Deadline
Admission	0 months
Take qualifying exam	0 months
Study list submitted	Third week of second semester
Prospectus and defense	8 months
First year committee review	12 months
Second year committee review	24 months

Apply for graduation	Approximately 3 months prior to graduation, check deadlines <a href="#">here</a>
Thesis defense	Approximately 2 months prior to graduation, check deadlines <a href="#">here</a>
Final thesis submission	Check University deadlines <a href="#">here</a>

### 3.7 Master of Science to Doctorate of Philosophy Transition

It is possible for students who are originally accepted into the master's program to transition into a doctoral program. To make this transition, master's students must complete the steps listed below within 2.5 calendar years of beginning the master's program. Only after all steps are completed will a student become a doctoral candidate. Note that a master's student who graduates before completing these steps may have to reapply or spend some time without student status and would therefore be unable to be hired by the department.

1. Declare intent to transition from master's to doctoral by February 15 of the second year.
2. Choose a doctoral degree advisor, and with the approval and support of the advisor arrange a prospective doctoral advisory committee composed of a chair (the advisor) and at least four committee members.
3. Pass with a grade of B- or better five graduate courses deemed appropriate for doctoral preparation by the prospective doctoral advisory committee. These will typically be 500 level or higher, but may not include Physics 691R, 696R, 697R, or 699R. At least two of the classes must be from the list of core courses for the sub-discipline. This list of classes must be submitted to the prospective doctoral advisory committee prior to the doctoral candidacy exam.
4. Successfully defend the master's thesis before the master's advisory committee.
5. Pass a [doctoral candidacy exam](#) with the doctoral candidacy exam committee. This committee is comprised of three members of the prospective doctoral advisory committee (not including the advisor), plus two other members of the graduate faculty that are appointed by the department graduate committee.

Steps 4 and 5 are typically combined into a single meeting for which the master's defense serves as the doctoral candidacy exam, with the relevant advisory committees overlapping as much as possible.

The doctoral candidacy exam committee may accept the successfully defended master's thesis as satisfying the [doctoral prospectus](#) requirement or they may require a separate doctoral prospectus defense. In either case, the transitioning student must submit a written doctoral prospectus, approved by the committee and the department, after being admitted to candidacy.

The above description of the master's to doctoral transition assumes the student receives the master's degree. A slight alternative is possible in the event the master's student does not necessarily want to receive the master's degree. All the previous steps must be followed but the written master's thesis may be replaced with a document representing the research the student has performed as part of their master's program. An example may be one or more peer-reviewed publications.

## 4. Doctorate of Philosophy Degree

### 4.1 Degree Requirements

Graduate students must do the following to receive a doctoral degree:

- Pass the qualifying examination.
- Complete 54 credit hours of coursework. This includes a minimum of 36 hours in approved courses and 18 hours for dissertation work ([699R](#)).
- Students with a master's degree may apply up to 18 credit hours of coursework from that degree toward the 36 required credit hours of approved courses.
- Create, with the help of the research advisor and graduate advisory committee, a list of approved courses to be taken. This is the program of study and will include:
  - Three required courses: Physics [601](#), [602](#), and 3 hours of [795R](#)
  - Physics and astronomy graduate courses chosen from:
    - Acoustics: Physics [660](#), [661](#), [662](#), [721](#)
    - Astronomy: Physics [529](#), [611](#), [612](#), [627](#), [628](#), [727](#), [728](#)
    - Atomic, Molecular, and Optical: Physics [641](#), [642](#), [651](#), [652](#), [731](#)
    - Condensed Matter: Physics [641](#), [642](#), [651](#), [652](#), [731](#)
    - Plasma: Physics [641](#), [642](#), [645](#), [651](#), [652](#), [721](#), [731](#), [745](#)
    - Theoretical and Mathematical: Physics [641](#), [642](#), [651](#), [652](#), [721](#), [731](#)
    - Up to 3 hours of Physics [697R](#).
    - Additional graduate level courses with approval of the advisory committee.
  - NOTE: Physics 601, 602, and the appropriate list above comprise the "core courses" of each sub-discipline.
- Complete Physics [696R](#) (Intro to Research) during each of the two initial semesters. This does not count toward the minimum of 36 hours of approved coursework.
- Complete Physics [691R](#) (Colloquium) every semester in residence. This does not count toward the required credits.
- Maintain a minimum GPA of 3.0 with each course on the program of study passed with a grade of B- or better.
- Complete all coursework.
- Register for at least two consecutive 6-hour semesters on BYU campus.
- Pass the [prospectus](#) examination.
- Pass the [doctoral candidacy](#) examination.
- Complete and defend a dissertation
- Complete all requirements above within eight years of admission.

### 4.2 The Graduate Advisory Committee

A graduate advisory committee is required for each graduate student. The doctoral graduate advisory committee consists of a chair (the student's advisor) and at least four other committee members. The chair should be a member of the Department of Physics and Astronomy. Committee members are usually from the Department of Physics and Astronomy though they may come from other departments as well.

The purpose of the graduate advisory committee is to

- Assist in defining and directing a suitable research topic.
- Provide direction on appropriate courses to take and their sequence.
- Provide research guidance and mentoring. This is principally the role of the chair/advisor.

- Monitor research progress, including:
  - a. Approving the written prospectus and its defense
  - b. Participating in annual progress evaluations
  - c. Ensuring active participation in a research group
  - d. Approving the candidacy exam
  - e. Approving the final dissertation and its defense

A graduate advisory committee is formally established on submission and approval of the [ADV Form 3](#), “Program of Study” form. This should be submitted to the graduate secretary and approved by the third week of the second year. Changes to the graduate advisory committee and the study list can be made by submitting [ADV Form 3b](#), “Program of Study Change”, to the graduate secretary. All changes should be made as early as possible in the program and with the consent of all committee members being affected.

### 4.3 The Prospectus

Each doctoral student must write and defend a prospectus by the end of their first year. A prospectus is intended to be a proposal to the student’s graduate advisory committee and to the department of the research that will be undertaken for the doctoral dissertation. It is to explain the proposed research, the significance of that research and the resources needed to successfully accomplish the research. A good prospectus will include a well-defined research problem and a reasonable research methodology. It should persuade the graduate advisory committee that the proposed work is both feasible and appropriate in significance, approach and scope to qualify as doctoral level work.

The course, Introduction to Research (Physics 696R), is partially intended to help each student develop a prospectus. Nonetheless, the prospectus is largely written under the guidance of the research advisor. For regularly progressing doctoral students, the prospectus should be written and defended by the end of the first year. Departmental research assistantships are awarded only following the successful completion of the prospectus defense.

LaTeX templates for prospectuses, theses and dissertations can be found at the [department website](#).

Once a prospectus is written, it must be defended to the advisor and the student’s graduate advisory committee. This defense entails an oral presentation given by the student to the graduate advisory committee. The presentation should discuss the proposed research, including necessary background, the methodology to be used, required resources, and the significance of the research. Those present are welcome to ask a range of questions about the proposed research as well as questions that probe the breadth and depth of the student’s understanding of the necessary background physics and astronomy. The graduate advisory committee makes a determination as to the quality of the written prospectus and oral presentation and the likelihood for success of the proposed research. Suggested modifications to the written prospectus may be made which the student should incorporate into the prospectus.

The following can be thought of as a rough sequence of events associated with the prospectus and its defense:

- Advisor and student agree on the written prospectus
- Student arranges a date, time and place with the graduate advisory committee for a prospectus defense.

- Student schedules the defense with the graduate secretary.
- The defense is held
- Student rewrites the prospectus addressing concerns and suggestions of members of the graduate advisory committee.
- Once approved by the graduate advisory committee, student secures signatures of the graduate advisory committee as well as the graduate coordinator.
- The approved prospectus is submitted to the department via the graduate secretary.

The approved version of the prospectus should be signed by the entire graduate advisory committee and by the graduate coordinator. The student should distribute copies of the prospectus to the advisor and each committee member. An additional copy should be submitted to the department via the graduate secretary. The prospectus becomes a part of the student's permanent graduate record and may be used to judge progress in the program, as one input for further evaluations, and to keep track of research expectations.

Although the prospectus does constitute an agreement of sorts between the graduate student, the student's graduate advisory committee, and the Department of Physics and Astronomy on the nature and extent of the proposed research, it is possible that as the student's research develops emphases will change. It is the student's responsibility to make sure that all advisory committee members are kept current on the progress and possible changes in the direction of the research.

It is possible to change the composition of the student's graduate advisory committee after the acceptance of the prospectus. The new advisory committee members should be given a copy of the prospectus before they agree to serve on the committee. Should a research topic or methodology change significantly, or should a student change graduate advisors, the graduate coordinator will determine in consultation with the advisor and advisory committee whether the student will be required to submit and defend a new prospectus.

#### 4.4 The Doctoral Candidacy Exam

The doctoral candidacy exam is intended to determine the student's research competency and productivity. This exam consists of a written manuscript and an oral presentation. Both describe the research and results of the graduate student since the prospectus defense. One example of the written report might be one or more peer-reviewed publications. For a master's student transitioning to a doctoral degree, it could consist of the master's thesis.

The candidacy exam should take place between 6 and 12 months following a successful prospectus defense. Before taking the candidacy exam, the student is required to have passed with a B- or better five courses from the "core courses" of the sub-discipline and the student's program of study.

Once the student and advisor determine the student's readiness to take the exam, it should be scheduled with the graduate secretary. The department graduate committee will then create a candidacy exam committee comprising the student's graduate advisory committee (only three members, not including the advisor, participate in the final vote) and two graduate faculty members not on the advisory committee. The student will provide copies of the written report to all members of the student's graduate advisory committee and the candidacy exam committee at least two weeks prior to the candidacy exam.

The oral presentation is open to the public. The graduate student may be asked to present an

overview of the work for the benefit of those not familiar followed by technical details of the research and the written manuscript. At the discretion of the examining committee, the public may be permitted to ask questions. At the conclusion of the presentation, the public will be excused and the committee may ask additional questions regarding the background and nature of the research, including past progress and the likelihood of future success. Questions may also be asked regarding the student's understanding of the graduate curriculum. The examining committee will then dismiss the student and will vote on one of the following options:

- Pass: The graduate student is formally admitted to doctoral candidacy.
- Recess: The graduate student's work is not currently satisfactory for admission to candidacy. At the discretion of the examination committee, the student may be asked to redo aspects of the exam at a later date or other arrangements may be made to give the student an opportunity to demonstrate research competency and mastery of the graduate curriculum.
- Fail: Failing the exam may result in dismissal from the doctoral degree program. Based on the student's research to this point, the examining committee may offer the student the option of completing a terminal master's degree.

#### 4.5 Graduation Application

Graduate students close to completion must apply for graduation through myBYU. This should be done early in the semester in which they plan to graduate. The deadline for this application can be found in the university calendar. Once an application is received, a review will be made of the student's graduation requirements. If any deficiencies are found, the faculty advisor and student will be notified. Applying for graduation is a prerequisite to scheduling the defense and being included on the official graduation list.

It is usually a good idea to apply before the deadline even if there is the possibility of a delay in graduation. If a student does not graduate during the originally intended semester, a deferral can be made to the next graduation opportunity.

#### 4.6 The Doctoral Dissertation and Final Defense

Upon completion of their research efforts, every graduate student presents it in a final document, called the dissertation, to the department. The nature of a dissertation is as follows:

- It must clearly contain original scholarly work. It is work that is a new contribution to the field. The work will often be represented by multiple peer-reviewed publications. The dissertation itself will include descriptions of the aims and results of the research. The dissertation itself will necessarily also include sufficient introductory and background information to acquaint readers who are scientists but not experts in the field with the nature and importance of the work.
- It must follow the form and style as dictated by the university and departmental regulations. Dissertation style guidelines are available on the BYU Graduate Studies website under [ETD Instruction Packet](#).

Once the graduate advisory committee agrees that the dissertation is in an acceptable form and is ready to be defended, a dissertation defense can be scheduled. A time and place should be scheduled with the graduate secretary. This will include submitting form [ADV Form 8c](#),

“Departmental Scheduling of Final Oral Examination,” and obtaining the requisite signatures of the graduate advisory committee members and the graduate coordinator. Defenses may not be scheduled on holidays or University breaks. To ensure sufficient time for a thorough review of the dissertation by the student’s advisory committee and the department, there must be at least two weeks between scheduling the defense and the date of the defense. The graduate student must provide each member of the advisory committee and the graduate coordinator with a copy of the dissertation more than two weeks prior to the date of the examination. Under no circumstances will the advisory committee have less than two weeks to review the dissertation.

The oral defense is open to the public. Students should consult with the chair of their graduate advisory committee to ascertain the format of the exam. Defending students may be asked to present a brief introductory overview of the research for the benefit of those not familiar with the work, and then present technical details at greater length. At the discretion of the graduate advisory committee chair, the public may be permitted to ask questions. At the conclusion of the presentation, the public will be excused and the graduate advisory committee may discuss with the student further technical issues, clarifications, or possible additional requirements. The graduate advisory committee then excuses the student and will decide on one of the following options:

- Pass
- Pass with qualifications: Student must complete minor revisions specified by the advisory committee. Once completed to the satisfaction of the advisory committee, the chair signs the appropriate paperwork for completion of qualifications.
- Recess: Student must retake the dissertation defense from the same advisory committee no sooner than one month after the first exam. Only one recess will be granted to a candidate. The new exam must be formally scheduled with the university following the same procedure as before.
- Fail: The graduate degree program of the student is terminated.

After appropriate revisions of the dissertation have been accepted and approved, the student submits their final dissertation to the department and university. This is done by completing and obtaining signatures for [ADV Form 8d](#), “Approval for Final Dissertation or Thesis.” Subsequently, the graduate student will upload their dissertation to the [ETD website](#) to receive department and college approval. Once the latter are granted the student submits [ADV Form 8d](#) to BYU Graduate Studies. Individual copies of the bound dissertation can then be obtained from the department by contacting the graduate secretary.

#### 4.7 Doctoral Student Checklist

The following is a convenient summary of milestones and their corresponding deadlines that will need to be met by any doctoral student. It is not necessarily comprehensive, but does list the major requirements and milestones.

Milestone	Deadline
Admission	0 months
Take qualifying exam	0 months; must pass within 20 months of admission date
Study list submitted	Third week of second year

Prospectus and defense	12 months
First year committee review	12 months
Second year committee review	24 months
Candidacy exam	No later than 30 months, preferably 6-18 months after prospectus
Third year committee review	36 months
Fourth year committee review	48 months
Apply for graduation	Approximately 3 months prior to graduation, check deadlines <a href="#">here</a>
Dissertation defense	Approximately 2 months prior to graduation, check deadlines <a href="#">here</a>
Final dissertation submission	Check University deadlines <a href="#">here</a>

## 5. Life of a BYU Physics Graduate Student

### 5.1 Graduate Student Offices

On admission and arrival in the department, each graduate student is assigned an office in the Eyring Science Center (ESC). Depending on size, three to four students will share an office. Contact information for graduate students in each office is posted outside the door.

### 5.2 Building Access

#### *Keys*

Offices and some research areas will require graduate students to have a key. In order to be granted a key, a student must pick up a “Key Issue Agreement” form in N273 ESC or N283 ESC. Once this is filled out, signed by the relevant supervisor, and turned in to the graduate secretary, a key will be issued. They are not to be lent out or given to any other person. Unauthorized lending of keys will result in the loss of key privileges, making access to office and research areas problematic. Fees for replacing a key can be up to \$50. When a key is no longer needed (e.g. graduation, leaving the university, or just changing offices), keys must be returned to N273.

#### *Electronic Access*

If access to a room that has a card reader is required, the “Access Request Form” can be picked up in N273 ESC or N283 ESC. The form must include the specific room number for which electronic access is requested and it must be signed by a supervisor. The form must then be turned in to the graduate secretary.

After-hours access to the building when it is locked at night or on holidays will need to be requested on this form as well since it’s an electronic card reader.

#### *Late Night Access*

If a student needs to be in the building late at night (between 11 PM and 6 AM), they must have a pass that needs to be worn at all times while in the building. This pass can be requested from the graduate secretary in N273 ESC.

### 5.3 Graduate Mailboxes

On admission and arrival in the department, each graduate student is assigned a personal mailbox with their name on it located in N283 ESC. These should be checked regularly as this is one way for the department to communicate important information to students. Small incentives may be offered to keep the mailboxes checked periodically.

### 5.4 Graduate Gobble

Once a week when classes are in session, graduate students are invited to the physics conference room (N209 ESC) for socializing and light refreshments. This is a chance to encourage ongoing interactions between graduate students across research groups. The hour and food is restricted to graduate students and is a great opportunity to unwind a bit and collaborate socially. Refreshments are provided by the graduate secretary’s staff.

## 5.5 Religion Courses

The department and university strongly encourage graduate students to deepen their understanding of the gospel of Jesus Christ by taking religion classes. When registered for at least two credit hours from a program of study, graduate students may take religion courses free of charge provided there is space in the class and the instructor gives written approval. To register for a religion class, graduate students must fill out [ADV Form 6](#) “Graduate Student Request for No-Cost/No-Credit Religion Course” (available on the [BYU Graduate Studies website](#)), have it signed by the course instructor and return it to BYU Graduate Studies. Please be aware that no academic credit is received for taking a religion class free of charge and it will not appear on a student’s transcript.

Note that graduate students should not register for religion classes through the university computer enrollment system. If a student registers in this way, the course will not be free of charge, the student will have to pay for it and a letter grade will be assigned.

## 5.6 Outreach and the Society of Physics Students (SPS)

BYU sponsors an active chapter of the Society of Physics Students. While geared largely at undergraduates, graduate students are welcome to take part, especially with physics outreach. SPS outreach takes many forms and has the particular goal of demonstrating to K-12 students the excitement of physics and science. For more information, contact Cheryl Davis, the SPS Advisor.

## 5.7 Graduate Student Society (GSS)

All BYU graduate students are members of the BYU Graduate Student Society (GSS). This is a university sponsored organization. GSS officers work directly with the Dean of Graduate Studies to represent graduate students to the university administration. The BYU GSS Council, which includes representatives from departments across the university, meets regularly to discuss the needs of the graduate student body and to make recommendations to the administration. In addition to representation, the GSS presidency and council serve to enrich, enhance, and encourage the BYU graduate student experience. They have regular activities such as seminars and doughnut days. They sponsor the University wide 3 Minute Thesis (3MT) competition which all graduate students are encouraged to participate in. More information can be found at [gss.byu.edu](http://gss.byu.edu).

## 5.8 Computational Facilities

The department has standard computing facilities available for the use of graduate students. On admission to the program, every graduate student is automatically given an account. Computer labs are located in N212 ESC and N361 ESC. For help in using these facilities, please contact the Computer Support Representatives (CSR) at 801-422-6776 or in their office N362 ESC.

High performance computing facilities are also available on campus through the Fulton Supercomputing Lab. For more information and how to get an account, go to [marylou.byu.edu](http://marylou.byu.edu).

## 5.9 Research Facilities

The department has a number of state of the art research facilities. These include a microscopy lab with TEM (transmission electron microscope), an anechoic chamber and reverberation room, a planetarium, telescopes, including a 0.9 m telescope at West Mountain Observatory, and access to supercomputing resources.

## 5.10 Ownership of Research

A crucial component of any graduate degree in the department is conducting scholarly research and creating new knowledge. This research is likely to be funded in part by a research assistantship, scholarship, internship, fellowship, tuition waiver or some combination of these. While graduate students will have considerable freedom in the selection of research projects, it is important to understand that all rights (including rights to income from sale or licensing), ownership, and title to research conducted at the university, including that leading to theses and dissertations will reside with Brigham Young University. In some cases, as specified by university policy, a division of income from the sale of intellectual property will be made with contributing students.

## 5.11 Safety Information

Students should be aware of issues pertaining to safety in the laboratory. They should discuss possible safety hazards with their advisor and ensure that any necessary safety training takes place early in the graduate experience. Some of this training is available online at [ytrain.byu.edu](http://ytrain.byu.edu).

Students should adhere to standard operating procedures (SOP) when using facilities such as the machine shop, the electron microscope, fume hoods, etc. Also, students must wear goggles at all times when around chemicals. If you choose to wear them at other times, please do so in a fashion responsible way.

## 6. Financial Assistance

The department recognizes that most students require financial assistance in order to remain in school. We make as much financial assistance available to each graduate student as is possible within the departmental and university guidelines and resources.

### 6.1 Tuition and Supplementary Awards

Full-time graduate students making acceptable progress toward graduation may qualify for a full tuition scholarship. Additional, supplementary awards may be granted. Such awards have, in the past, been used by graduate students to help defray other expenses, including student health insurance, books, computer equipment, etc.

### 6.2 Teaching Assistantships

During fall and winter semesters, the department offers teaching assistantships (TA) with pay scales according to experience and progress and based on the university policy of 20 working hours for pay allowed per week:

	Per Semester	Full Year
First Year	\$7,360	\$22,080
Second Year	\$7,562	\$22,686
Third Year	\$7,667	\$23,001

Many graduate teaching assistants work in the departmental tutorial labs, and some teach physics labs or do grading for physics courses. During spring and summer terms first year students (and others who do not qualify for a research assistantship) may be hired as teaching assistants. If a student receives financial support from the department, they must be available to work as a teaching assistant according to department needs and assignments.

To be hired as a teaching assistant, the department will need information from students regarding their preferences about the type of assignment and the number of hours to be worked. This information can be provided at <http://gardner.byu.edu/tas/>.

### 6.3 Research Assistantships

The department offers a limited number of research assistantships and/or internships up to 20 hours a week with pay scales according to experience and progress and based on the university policy of 20 working hours for pay allowed per week:

	Per Semester	Full Year
First Year	\$7,360	\$22,080
Second Year	\$7,562	\$22,686
Third Year	\$7,667	\$23,001

Typically, more research assistantships are offered spring and summer terms. The purpose of these sources of funding is to provide students with financial support and experiential learning. Master's students and doctoral students nearing graduation will be given priority for research assistant positions. A prospectus must be written, defended, approved and submitted before departmental research assistantships will be awarded.

## 6.4 Conditions for Support

Departmental funding will be guaranteed for two years plus one semester for a master's student and for five years for a doctoral student. Advisors with external funds may support students for longer than this, but it is expected that tuition will be part of such external support.

The financial support discussed above is not automatic and the department can reduce or terminate support if:

- A graduate student does not satisfactorily perform the duties required of the assistantship, teaching or research.
- A graduate student does not take enough classes from their program of study to make adequate progress toward the degree.
- Research funds become unavailable.
- A graduate student pursues unauthorized employment unassociated with their degree program.

## 6.5 Outside Employment

The department expectation for a full-time, degree seeking, graduate student is that the pursuit of such a degree should be the primary objective of that student. The department in turn makes a considerable investment in each student and their success. Hence, the department strongly discourages students from seeking or obtaining outside employment while full-time students. Working outside the department can jeopardize department support in the form of teaching or research assistantships. While there may be circumstances that necessitate employment outside the department, ongoing TA or RA support will require clearance from the graduate coordinator or department chair.

## 6.6 Student Loans

The university makes short term loans available and has information about government approved loans. No loans are available through the department. Information about student loans can be found by contacting [BYU Financial Aid](#) located in D-155 ASB.

To defer loan payments, students will need proof of full-time student status from BYU Graduate Studies. To qualify, students who have completed their coursework will need to be registered for a minimum of two credit hours and working on research full time. Students must fill out and return [ADV Form 2a](#), "Request for Graduate Full-time Status," to BYU Graduate Studies.

## 7. Research Areas

The Physics and Astronomy Department at Brigham Young University is part of BYU's graduate program. General information about BYU's graduate programs can be found in the official [BYU graduate catalog](#).

Our department offers three graduate degrees:

- Doctorate of Philosophy in Physics
- Doctorate of Philosophy in Physics and Astronomy
- Master of Science in Physics

The "Program Outcomes" section in the [graduate catalog](#) gives the purpose and expected outcomes for each of the degrees. Students should be familiar with these outcomes and periodically assess their progress against them. The "Program Stat" section in the [graduate catalog](#) gives the basic statistics of the degree program, such as the number of students enrolled and average time to graduation.

The department offers degrees in six programs:

- [Acoustics](#)
- [Astronomy](#)
- [Atomic, Molecular, and Optical Physics \(AMO\)](#)
- [Condensed Matter](#)
- [Plasma](#)
- [Theoretical and Mathematical Physics](#)

All programs culminate in a Master of Science or Doctorate of Philosophy in Physics except astronomy which has the separate designation of "Doctorate of Philosophy in Physics and Astronomy" for its doctoral degree.

### 7.1 Faculty Research Interests

1. ALLRED, David, Professor
  - a. Creating the next-generation mirror coatings for broadband space telescopes. Broadband means extreme ultraviolet, UV, optical and IR
  - b. Sputtering, vapor deposition, and evaporation thin-film and nanofabrication techniques
  - c. Characterizing thin films and surfaces with ellipsometry, AFM and other surface sensitive techniques
  - d. Infiltration of carbon-nanotube forests to make novel microstructures
  - e. EUV and soft x-ray optics
  - f. Basic science questions relating to above projects and to energy conversion
2. ANDERSON, Brian, Associate Professor
  - a. Time reversal acoustics
  - b. Nondestructive evaluation of cracks and mechanical defects
  - c. Focusing sound in rooms for private communications
  - d. Nonlinear acoustics
  - e. Electro-mechano-acoustic transducers and arrays

3. BERGESON, Scott, Professor
  - a. Laser cooling and trapping
  - b. Precision atomic spectroscopy
  - c. Rydberg atoms
  - d. Ultra-cold plasma physics
  - e. Ion trapping
  
4. CAMPBELL, Branton, Professor
  - a. X-ray and neutron diffraction studies of atomic structure in materials
  - b. The relationship between atomic structure and exotic physical properties in functional materials (e.g. superconductors, ferroics and multiferroics, piezoelectrics, relaxors, magnetoresistors, magnetocalorics, microporous catalysts, and energy materials)
  - c. Applications of group theory and topology to understanding and designing material properties
  
5. CHESNEL, Karine, Associate Professor
  - a. Nanomagnetism
  - b. Thin ferromagnetic films and multilayers
  - c. Magnetic domain topological phase transitions
  - d. Magnetic domain memory
  - e. Superparamagnetic nanoparticles
  - f. Coherent x-ray resonant magnetic scattering
  
6. COLTON, John, Associate Professor
  - a. Experimental condensed matter physics, in particular semiconductor nanoparticles and nanostructures
  - b. Specialties include materials physics, optical properties, and electron spin properties
  - c. Current materials being studied include semiconductor nanoparticles in hollow ferritin proteins, other semiconductor nanoparticles, platinum nanoparticles, and thin ZnO and ZnAs layers grown on substrates
  
7. DAVIS, Robert, Professor
  - a. Use of advanced composite materials and micro/nano manufacturing to solve problems of societal interest
  - b. Bead based microfluidic separations of rare cells from blood to facilitate bacterial infection and cancer diagnostics
  - c. Nanostructured battery and capacitor electrodes for high density energy and storage and management
  - d. Microfabricated thermal GC columns for molecular diagnostics in health and security
  
8. DURFEE, Dallin, Associate Professor
  - a. Optics and imaging, lensless imaging, structured illumination imaging
  - b. Atom interferometry and precision measurements
  - c. Atomic clocks
  - d. Single frequency laser technology
  - e. Laser cooling

9. GEE, Kent, Professor
  - a. Nonlinear acoustics
  - b. Jet and rocket noise
  - c. Array processing
  - d. Physics education
  
10. HART, Grant, Associate Professor
  - a. Computational investigation of waves in non-neutral plasmas, including electron and pure-ion plasmas
  
11. HART, Gus, Professor
  - a. Machine learning for materials discovery
  - b. High-throughput materials science database generation
  - c. Accelerating density function calculations
  - d. Algorithm development for computational materials modeling
  - e. Crystal structure enumeration
  - f. Scientific software engineering
  
12. HINTZ, Eric, Associate Professor
  - a. Primarily interested in the nature of pulsating variable stars, in particular, delta Scuti and gamma Doradus stars
  - b. Other areas of interest include light variation in quasars and other AGN's and clusters of galaxies
  
13. HIRSCHMANN, Eric, Associate Professor
  - a. Gravitational radiation from binary compact object mergers
  - b. Strong gravitational fields associated with gravitational collapse, neutron stars and black holes
  - c. Numerical general relativity
  - d. Computational relativistic magnetohydrodynamics
  - e. Critical behavior and scaling phenomena in non-linear theories
  
14. JONER, Michael, Research Professor
  - a. Detection of transiting exoplanets and characterization of extreme hot Jupiters using precision observing techniques
  - b. The study of active galaxies to determine black hole masses through reverberation mapping along with continued monitoring of various monitoring of active galaxies such as blazars and Seyferts
  - c. Precision photometric observations and time domain studies of a wide variety of variable sources such as pulsating stars, eclipsing binaries, supernovae, Be stars, transiting exoplanets, and active galaxies
  - d. Photometric standard system comparisons and transformation techniques
  - e. Public outreach and amateur-professional collaborations

15. LEISHMAN, Timothy, Professor
  - a. Acoustics and electroacoustics
  - b. Architectural acoustics of critical listening environments and auditoria
  - c. Electroacoustic transducers
  - d. Sound reproduction and reinforcement
  - e. Active control of reproduced sound fields, sound transmission, and noise
  - f. Sound radiation from acoustic sources
  - g. Energy-based acoustics
  
16. MOODY, J. Ward, Professor
  - a. Extragalactic astronomy, galaxy clustering, observational cosmology: Mapping the spatial distribution of galaxies in low density volumes
  - b. Automated observing with remote telescopes
  
17. NEILSEN, David, Professor
  - a. General relativity, black holes, and neutron stars
  - b. Relativistic astrophysics
  - c. Computational fluid dynamics
  - d. High-performance scientific computing
  - e. Adaptive wavelet multi-resolution computational methods
  
18. NEILSEN, Tracianne, Associate Professor
  - a. Underwater acoustics
  - b. Acoustic source characterization and localization
  
19. PEATROSS, Justin, Professor
  - a. Atomic and laser physics: interactions of high-power laser pulses with matter
  - b. Relativistic dynamics of electrons in intense laser fields
  - c. Vector diffraction of electromagnetic fields
  
20. RAGOZZINE, Darin, Assistant Professor
  - a. Orbital Dynamics in Planetary Science: non-Keplerian dynamics, long-term integrations, resonances, tidal evolution
  - b. Exoplanets: systems of multiple transiting exoplanets, Kepler Space Telescope, architectures of planetary systems, multi-transiting geometric probability, Transit Timing Variations, photodynamical modeling
  - c. Outer Solar System: dwarf planet Haumea, Kuiper Belt Objects, collisional families, binaries, multiples, dynamical classification
  - d. Observations: Hubble Space Telescope, Kepler, JWST, TESS, WFIRST, New Horizons Extended Mission
  - e. Astrostatistics, Bayesian statistics, Approximate Bayesian Computing, Markov Chain Monte Carlo
  
21. REES, Lawrence B., Professor
  - a. Experimental and computational nuclear physics, materials analysis: Neutron detector development and testing, accelerator based materials analysis

22. SOMMERFELDT, Scott, Professor
  - a. Acoustics and vibration
  - b. Active control of enclosed acoustic fields
  - c. Active control of structural vibration and radiation
  - d. Passive noise control techniques
  - e. Development of energy-based techniques for controlling sound and vibration
  - f. Sound-structure interaction
  - g. Energy-based acoustical measurements
  
23. STEPHENS, Denise, Associate Professor
  - a. Transiting Extrasolar Planets
  - b. Atmospheric Properties of Brown Dwarfs
  - c. Brown Dwarf Binary Systems
  
24. TRANSTRUM, Mark, Assistant Professor
  - a. Information Physics
  - b. Modeling Complex Systems--Biology, Engineered Systems, Neuroscience, Machine Learning
  - c. Materials Science
  
25. TURLEY, R. Steven, Professor
  - a. Computational Field Theory, laser physics, and plasma diagnostics
  - b. Development of high-order and efficient numerical techniques for solving scattering, radiation, and propagation problems with vector and scalar fields
  - c. Development and diagnosis of soft x-ray and extreme ultra-violet radiation sources
  
26. VANFLEET, Richard, Professor
  - a. Atomic and near atomic scale studies of materials by transmission electron microscopy
  
27. WARE, Michael, Associate Professor
  - a. Atomic and laser physics: interactions of high-power laser pulses with matter.
  - b. Quantum optics
  - c. QED numerical models

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