Graduate Student Handbook

2022-2023

Department of Physics & Astronomy

The University of Toledo

First Version

2022: Samuel Beiler, Bailey Frye, and Victor Johnston

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Updates

INTRODUCTION

This is an effort to present useful information to all graduate students. This handbook covers issues that students may experience on a daily basis and policies that govern their academic maturation. Most information a graduate student needs is not contained in a single document or university department website. By combining information from these various sources, we hope to answer questions that may arise during your time at the University of Toledo.

ACADEMIC POLICIES

Please see the graduate catalog, Graduate Student Handbook, and the Physics and Astronomy degree requirements for complete information and current policies. Email the Graduate office or the Physics and Astronomy office if you have questions.

https://www.utoledo.edu/graduate/files/GraduateStudentHandbook2021-22.pdf

https://catalog.utoledo.edu/pdf/2021-2022-graduate.pdf (Degree Requirements can also be found here)

https://www.utoledo.edu/nsm/physast/programs/grad/current_grad_students.html

Plan of Study for the Doctoral Degree

Each student working for a degree is required to file a Plan of Study with the College of Graduate Studies prior to the completion of 12 credit hours of coursework. This should be one of the first things that you and your selected advisor discuss. A Plan of Study lists all the courses that you intend to take, the number of credit hours, and when the course is to be taken. It should contain all the required courses as well as any courses that would aid in your own research. The total number of credit hours for courses numbered 6100 and above - including Ph.D. research which is limited to a maximum of 60 credit hours - must total 90 credit hours. Plans should be submitted early so your schedule can be set, as some courses may not be offered every semester or every year (see attached document at the end). The Plan needs to be approved by your advisor, the department chair, and the Graduate School and must satisfy your degree requirements and offer letter. The form should be updated when any significant changes occur (i.e., M.S. to Ph.D. switch), but does not need to be updated each semester. Blank forms are available at http://www.utoledo.edu/graduate/currentstudents/academicprogramforms or possibly in the Department Office.

One suggestion: only list courses on the form that you actually intend to take. Any courses not taken by graduation have to be explained. If you think you might like to take a course, but are not sure, leave it off. It is easier to explain that you have taken more than expected than it is to explain why you did not complete the submitted and approved Plan. Courses not offered by the department may not be subject to tuition waiver. Students may take courses outside of the department following approval by their advisor and department chair after amending the plan of study. Students in the final semester of Ph.D., program may register for reduced course load.

Annual Graduate Student Progress Report

Each student is required to file a Progress Report with the Department by early February. This will include meeting with your advisor and/or your thesis committee to discuss your progress, what hurdles you need to overcome, and if you are following your graduation timeline, then obtaining their signatures afterwards. This form may be found at the end of this handbook.

Grades

As a graduate student, you must maintain a GPA of 3.0 or higher at all times. Should you fall below this standard, you will be placed on academic probation. Failure to be removed from academic probation within one semester can result in loss of your assistantship and removal from the graduate program. All classes reported on your Plan of Study form must have a grade of "C" or better. The Graduate School considers grades of "C-" or less unacceptable. There is no academic forgiveness policy for retaking to delete lower grades.

Job Descriptions/Duties

Graduate assistants will be assigned specific duties by their immediate supervisors either as teaching assistants or research assistants. Graduate assistants should completely understand their duties before beginning the academic semester in which they are assigned. An assistant can be terminated for one or more of the following: neglect of duty, failure to make adequate progress toward the degree, incompetence, and/or financial condition of the University. Terminations of Graduate Assistantships due to any of these conditions may cause revocation of all or a portion of the tuition scholarship. The decision to terminate will involve the College of Graduate Studies and the Graduate Assistant's immediate supervisor.

Policy on Other Employment Work

Since teaching and research assistants are expected to spend their time carrying out their assistantship duties as well as taking courses and carrying out research, additional (off-campus) employment outside the graduate assistantship must not be assumed by the student. Graduate students pursuing additional on-campus employment, in addition to their graduate assistantship, must obtain prior approval from the college of Graduate Studies before they start working, by filing out the "Request for Additional On-Campus Employment" form. http://www.utoledo.edu/graduate/forms/RequestForEmploymentOutsideOfGradAsstDuties.pdf Forms can be submitted to College of Graduate Studies, Room3190; prior to beginning additional employment.

The main focus of graduate students with assistantships is to work full or part time towards their degree; which depends on enrollment requirements for the assistantship. Exceptions will be made only for assignments on a per semester basis if student has a minimum GPA of 3.0. All forms submitted after the student starts additional employment will be denied.

Students may work a maximum of 20-30 hours per week as a part of assistantships and other on-campus work, with the maximum differing based on semester and student residency. For more details see:

https://www.utoledo.edu/graduate/currentstudents/graduateassistants/employmentoutsideofassist.html

Registration

Registering for classes can be done online at myut.utoledo.edu (specifically https://banxe.utoledo.edu/StudentRegistrationSsb/ssb/registration). Follow your plan of study or your offer letter. If there are any complications, contact your advisor or Lisa Selmek in the Department Office. Make sure this is completed by the required dates each semester, which will often be sent out by one of the administrators.

Change from M.S. to Ph.D. or Ph.D. to M.S program

Students in the M.S. program that wish to change to the Ph.D. program or vice versa must submit a formal application online prior to the deadline for outside applications (see link at the end of the paragraph). In addition to the information required of all applicants, the student must state clearly their reasons for requesting the degree program change, and must provide a supporting statement from their major professor and obtain approval from the Graduate Retention and Graduation Committee. See the M.S. and Ph.D. requirements at the end of the document for additional information.

(http://www.utoledo.edu/graduate/changeofgraduateprogram.html)

DEPARTMENT INFORMATION

Teaching Assistant Duties

As a new teaching assistant (TA) there are many new things for you to learn. Although this document will be unable to tell you how to teach or deal with difficult students, we can lend some advice on the daily issues like supplies, photocopying, and point you towards resources for those more difficult issues. That said, your primary source for information about your TA duties will be your supervising professor, which will either be your lab coordinator or the lecturer you have been assigned to.

Teaching Labs

Song Cheng and Rick Irving are the lab coordinators responsible for coordinating all of the department's physics labs, whereas J.D. Smith is responsible for the astronomy labs. They are your primary resources for all teaching labs and will provide/point you to all of your supplies. Please note that Rick can also help you find equipment that is shared among several labs. Do not remove any supplies without asking your coordinator. You will often also have a lead TA who can help to answer questions when Rick, J.D., and Song are unavailable.

If an emergency comes up that will cause you to miss your lab and you are unable to find someone to substitute, contact the Physics & Astronomy office (419.530.2241).

Photocopies

If you need to make photocopies for your students, you may use the photocopier in the department office. Should you require more than 25 copies, fill out a copy request form in the office and give Lisa 24 hours notice. If you have an "emergency", ASK. Lisa or a student worker may be able to run copies on the copier.

For printing, there are printers in various places on campus, including the PandA lounge, Ritter 2nd floor, and McMaster 4th floor computer lab.

Department Administrators

Currently, the departmental administrators are Lori Burkholder and Lisa Selmek, and their offices can be found in McMaster 2017. Lisa will be your primary contact person for most day-to-day issues. Lori will handle budget and personnel issues. Below is a guide for you to use to obtain answers to questions and solutions to problems that will occur. Remember, it is only a guide. Feel free to ask either a question, should the other be unavailable. But please remember to give them the respect and patience they deserve - they make the department run!

Lisa:

- Keys (for when you need to order your own, or you need to borrow one)
- Office equipment dilemmas
- Graduate School forms (Plan of Study, Registration, etc.)
- Opening classes and other scheduling issues
- Booking rooms/Checking for conflicts
- Mail

Lori:

- Personnel paper work (including department appointment forms, tuition waivers)
- Paychecks and Health Insurance
- Financial reimbursement (seminars, travel expenses) from the department

If you are in a research lab with grant support, you may need to interact with Lori on grant purchases or travel reimbursements. Typically, she interacts with the Principal Investigator(s) on the grant or their designees (i.e., technician/postdoc).

Keys

Be sure to contact Lisa as soon after arrival as possible to complete a key request form for each key you will need. Only request keys for the rooms to which you will need access; i.e. your lab, office and, teaching lab. It may take several weeks before you will receive your new keys. Please safeguard their security, as you are responsible for the replacement cost of any lost keys (a charge of $25 per lost key). When you graduate you must return all your keys to the Transportation Center, Key Control; any unreturned keys will cost you (not the department) $25.

Technical and Computer Duties

Rick Irving is in charge of the Physics and Astronomy Department's many computer and IT resources. If you need account access for printing, internet, or getting various licenses for software, he is often the person that can help you or point you in the right direction. This makes him incredibly busy, so be respectful of his time by spending 10 minutes checking with your advisor and/or searching the university IT help desk site (https://www.utoledo.edu/it/CS/HelpDesk.html) before going to him.

Public Computer Clusters

There are several public computer clusters that serve the entire campus. Including one in McMaster on the 4th floor with a printer. You may need your Rocket Card and/or a UTAD account in order to use these facilities. An individual UTAD account can be created at no cost at myUTaccount.utoledo.edu.

GRAD TASKS AND GSA

Physics and Astronomy Graduate Tasks

All graduate students in the Department of Physics and Astronomy are expected to participate in the various tasks assigned by the department. There will be a meeting at the beginning of each year to refresh you on the tasks and allow you to volunteer for specific positions, which will be assigned by the Grad Task Coordinator. These range from colloquium setup, department photographer, and various planning committees. Your participation is required and helps the department run smoothly.

Graduate Student Association (GSA) – located in Student Union Room 3514

All graduate students are members of the GSA, and as members are eligible for travel grants. Students presenting papers or posters at a conference are eligible for $100. **Active members are eligible for more, so consider being an active member**. Deadlines for submission are near the middle of the semester; the GSA will notify graduate students of the deadlines as soon as the dates become available. It is important to remember that the monies will not be released until the semester after the application has been submitted. More information can be obtained by contacting the GSA or visiting the GSA web site https://graduatestudentassociationblog.wordpress.com/.

STUDENT PERKS AND OTHER INFORMATION

Physics and Astronomy (PandA) Student Lounge

McMaster 2024 serves as the student lounge. The cleanliness of this area is dependent on everyone. The custodians will empty the trash and occasionally mop the floors, but graduate students are all responsible for keeping the area clean.

E-Mail

E-mail is available free of charge to all registered UToledo students. To access accounts, you must first go to email.utoledo.edu. Check on Secure Access and enter your utad login ID or name and your password. You must maintain a UToledo e-mail account and check it regularly for university or departmental messages.

Student ID Cards and Account

For many different services (library, athletic events, computer clusters, registration, etc.) you are required to present your student ID card and/or account. You will be issued one free card at Parking Services, Rocket Hall 1917, ext. 5843. If you lose or have your card stolen, you will need to purchase a new one. Similarly, an individual fee account can be created at Rocket Hall.

Student Recreation Center

All UToledo Students are entitled to use the Student Recreation Center free of charge once you have your ID. The facilities include a half Olympic-sized pool, a diving well, swirly slides, sauna, hot tub, nautilus machines, indoor soccer, basketball, volleyball, squash and racquetball courts, running track, climbing wall, foosball, pool and table tennis, as well as many other activities. Memberships are available at reduced rates for family members, spouses, and significant others. You can call x3700 for information on these memberships and to find out times of operation that vary through the year.

Library Services

The Carlson Library (CL) offers several different services to students. In order to check out books and use facilities, you will need your student ID card. The library has a web page with an electronic card catalog serving books, journals, and audio-visual materials. One feature that is free is the Interlibrary Loan services. To obtain a book that our library does not have, you can order it over the Internet on the library home page http://www.cl.utoledo.edu/. To obtain a journal article that our library does not have from the Northwest Ohio Depository you must file a request through the CL website.

For further questions regarding Carlson Library call ext. 2324, or visit the information desk.

The University of Toledo's Health Science Campus also houses many resources that may be of particular interest to our graduate students. These include updated textbooks, online journals and

other resources, which can be found at the Mulford Library. Mulford Library's phone number is 419-383-4225 and it is located at 3045 Arlington Ave.

OPERS

As a state funded institution, the University of Toledo requires employees to pay into one of the state retirement systems (OPERS, STRS, LEO) instead of Social Security. **Students have the option to request an exemption from contribution while working and attending classes. This election needs to be made within 30 days of start date.** While not attending classes, students are not exempt and are required to contribute to OPERS.

Health Insurance

Health insurance is required for enrolled students. UToledo automatically enrolls the following students in the student health insurance plan and assesses a fee to your student account:

- All domestic graduate students registered for 6 or more credit hours per term
- All international students registered for 1 or more credit hours per term

You may waive the student health insurance plan if you have medical and prescription drug coverage under another plan. To do so, log into the MyUT portal, then submit a waiver request to have the premium removed from your student account at https://www.universityhealthplans.com. A new waiver is needed every academic year.

For more details, see https://www.utoledo.edu/depts/hr/benefits/student/ . If you have any other questions or concerns, contact Tonya Tressler, Insurance Management Representative, at the Student Medical Center, at Ext. 3474, or email studenthealthinsurance@utoledo.edu. Even with insurance, additional medical charges may be incurred that will be the responsibility of the student and not the department. Please note that purchasing the plan through the University of Toledo does not ensure that all doctors at UTHSC will accept that insurance. Always ask before scheduling a visit with any doctor, since any medical charges incurred will be the responsibility of the student and not the department. More details on insurance policies can be obtained from the human resources website listed under benefits (http://www.utoledo.edu/depts/hr/).

Parking

Parking on campus can be challenging, especially if you come to school in the middle of the day. The best times to find a spot are early in the morning, late in the afternoon, 10 minutes before the hour, and 5 minutes after any hour.

Student parking permits for all incoming and returning students, with the exception of Health Science Campus students is available for each semester and details are available under https://www.parkutoledo.com/wp-content/uploads/university-toledo-how-to-purchase-permit.pdf . The website for parking services is https://www.parkutoledo.com/.

There is a shuttle service available on campus as well. For schedules and fare information call the Transit Services Office at Ext. 1026, or visit their website at http://www.utoledo.edu/facilities/transit/.

Housing

The Office of Residence Life now offers housing for graduate students, but there may be a waiting list. Payroll deduction is also available for housing. For more information on this living option, contact the Office of Residence Life (ext. 2941) or refer to the website at http://www.utoledo.edu/studentaffairs/reslife/index/. A majority of graduate students choose to live off-campus.

Textbooks

There are various places to buy and resell your textbooks. The UToledo Bookstore, located on the second floor of Barnes & Noble at Gateway, Secor/Dorr, carries supplies and has reasonable prices. Your second choice is the off-campus Bancroft Student Bookstore. A third option may be found on the Internet at any of the bookstore sites. You will need to have the correct title and it is helpful to have the authors and edition or ISBN numbers. You can easily get these by asking the professor who is teaching the class. Books ship within 1-5 days after the order is placed and usually cost less than or the same as the UToledo Bookstore (Barnes & Noble) on campus.

Website

Additional information about the Department, GSA, graduate programs, and faculty research can be found on our website https://www.utoledo.edu/nsm/physast/.

QUALIFYING EXAMINATION, FINDING AN ADVISOR, COMPREHENSIVE EXAMINATION, AND THE DISSERTATION DEFENSE

These exams are key milestone on the progression to receiving a Ph.D. in this Physics and Astronomy Program.

Qualifying Exam

The qualifying exams are used to determine whether PhD graduate students have a grasp of basic physics at an advanced undergraduate level (PHYS 4000/5000 level courses at UToledo). The exam consists of a written and oral component as described below. Written approval of the graduate students' advisor is required for all exam takers and forms will be provided prior to the exam date.

The Ph.D. Qualifying Examination is composed of two parts: the written examination and the oral examination. Both parts of the examination are given in the beginning of the fall and spring semesters. The student's performance in either part is judged independently of the other part. That is, the

student's performance on the written examination has no bearing on whether or not they pass the oral examination and vice versa. In any given attempt at the Qualifying Examination, the student can pass both parts, fail both parts or pass one part but not the other.

Graduate students must pass both the written and oral parts of the Ph.D. Qualifying Examination no later than their fourth semester in our program. Students are expected to take the Qualifying Examination during the fall semester of their second full academic year. Students who do not pass both parts of the examination at that time are advised to either pursue a terminal M.S. degree or to take the Qualifying Examination (for the last time) during the spring semester of their second full academic year (see also section on exam timing on p. 13).

Written Exam

The written portion covers content of the core physics courses, divided into three sections: classical mechanics (CM), quantum mechanics (QM), and electromagnetism (EM). Typical content will include problems in Lagrangian mechanics, boundary-value problems in E&M, and problems in 1-, 2-, and 3-dimensional QM including operators and angular momentum.

Each section typically contains three problems (i.e. three CM, three QM, and three EM). Two problems from each section must be attempted for a total of 6 problems in the 4-hour exam period. If more than two problems in a section are attempted, the student must choose which 2 they wish to be graded. In the grading process, the exam committee separately evaluates each of the three sections. A passing grade is given when none of the individual sections is too weak and the total number of points is above a passing grade as determined by the department faculty each year depending on the exam difficulty. The student should keep in mind that partial credits are given for each attempted problem even when it is not completely worked out. No calculators or other hand-held devices are allowed.

The written exam is usually held on the fourth or fifth Saturday of the fall and spring semester. It is held generally from 9 am – 1 pm though specific times may vary by semester. It is held in McMaster Hall. Students are assigned seats by the proctors, and these may be reassigned during the exam duration as well. Students are expected to complete the exam honestly. Strict action will be taken according to University guidelines if cheating is found to occur. If a student has difficulty entering McMaster Hall on the day of the exam, the student should contact campus police at 419-530-2601 (non-emergency). The police will respond in time and give access to the building. The student will need to have his/her Rocket ID Card in possession to show to the responding officer. Additionally, the student can acquire, in advance by at least a week, a contact number from the Chair of the Qualifying Committee to gain access. It is the student's responsibility to obtain this number.

Oral Exam

The oral exam is administered separately for each individual student by a committee of three faculty, lasting approximately 1 hour. It covers a wider range of topics in physics and astronomy. It is used to determine a student's strengths and weaknesses and assess their ability to think and respond like scientists in a logical manner. Concepts are often expected to be explained in a purely qualitative, semi-quantitative, and/or semi-empirical manner. The oral exam normally starts with a self-introduction in which the student is asked to briefly describe any prior research experience and its related physics. The committee members typically then ask the student questions related to that introductory part as well as more general questions to explore the student's understanding of physics. It is expected that the student will be able to write on a black- or white- board to answer questions.

Exam Timing

The written exam is offered each fall and spring semester, with the oral exam being offered during the following few weeks. Each portion of the qualifying exam must be passed within the first two years of entry for those beginning in the fall semester. The exams may be attempted:

0. The "zeroth" attempt may be taken the first fall semester after entry. Though this attempt is not required, all entering students are strongly encouraged to take benefit of this opportunity to pass.
1. One year after entry
2. The following January, a year and a semester after entry.

Notes:

- For students who enter the program in January, this policy's timetable starts the following fall. In that case, therefore, the zeroth attempt takes place the fall semester after entry. The zeroth and first attempts may not be made in January, except by students who entered the program with previous post-bachelors level academic experience in physics. With their advisor's approval, they may accelerate the standard timetable above.
- Students are not required to take both the written and the oral part on the first attempt. However, both parts must be passed within a year and a semester after the student's first fall semester. Therefore, a student who takes only one part at the first attempt and passes it may take the other part for the first time the following January and must pass it at that time.
- In order to be eligible to take the qualifier at any of the three attempts, students must sign the form that will be provided, obtain the signature of their advisers, and submit the form to the chair of the Exam Committee by the appropriate deadline.
- Students whose highest goal is the M. S. are not required to take the qualifier. If, after receiving the M. S., a student is admitted into the Ph. D. program, they will be treated in the same way as a student who enters with an M. S. obtained elsewhere. The first required attempt is a year after entry into the Ph.D. program.

Resources and preparation

Written exams from previous years are posted online at: https://www.utoledo.edu/nsm/physast/programs/grad/qualify_exams.html#writtenexams

The following books typically represent the degree of difficulty and topics covered in the written section:

> "Classical Dynamics of Particles and Systems" by Stephen T. Thornton and Jerry B. Marion.
>
> "Analytical Mechanics" by Fowles and Cassidy.
>
> "Introduction to Electrodynamics" by David J. Griffiths, first 9 chapters.
>
> "Introduction to Quantum Mechanics" by David J. Griffiths, first 6 chapters.

Topics in the oral exam include those in the written exam, introductory physics courses, as well as questions related to the student's previous research experiences. Additional topics in Modern Physics include, but are not limited to, special relativity, quantum statistics, blackbody radiation, multi-electron atoms, basic concepts of quantum and classical mechanics encountered in introductory and intermediate physics classes, and interaction of electrons with magnetic fields (Zeeman effect, Stern-Gerlach experiment). A thorough knowledge and understanding of the contents from the books "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles," by Robert M. Eisberg and Robert Resnick and "Modern Physics" by Kenneth Krane will help to prepare for the oral exam. Other sources of equivalent content will also suffice.

Research Advisor

Graduate students must have a research advisor by the end of the spring semester of their first full academic year. Failure to have a research advisor can result in the termination of financial support.

Comprehensive Exam

Graduate students must take the Comprehensive Examination no later than the end of the summer after the student's third full year in our program. This examination is administered by the student's Ph.D. committee. The Comprehensive Examination is an oral exam designed to:
1. assess the student's grasp of physics at the 6000 level, especially (but not exclusively) the physics needed for dissertation research in the chosen area.

2. assess the student's preparedness to do dissertation research. The time spent in the exam should be divided approximately equally between these goals.

The purpose of the Comprehensive exam is to make sure that the student has a set plan for finishing their thesis work, as well as the background knowledge and skills required for their project. Aside from the topics listed above, the exam usually consists of a roughly hour long presentation of your current work, as well as the work needing to be done that will encompass your thesis project. This includes the number of papers that the student expects to publish, as well as a timeline of major milestones from current day to graduation. The exam is given to the student's committee members

who then decide if any adjustments or additional work are required. Once the committee is satisfied with the student's plan of action, the comprehensive exam is complete. The student will then have their advisor email the main physics office about their successful comprehensive and that will be the last step. There is no official paperwork to be filled out other than informing the main office of your completion.

The Dissertation Defense and Graduation

After the student completes the Comprehensive Examination, only the dissertation research and defense requirements remain. The graduate program ends with the presentation of the dissertation and its satisfactory defense in the oral defense examination.

Dissertation:

The student will provide a copy of their dissertation to their Ph.D. committee no later than one week before the scheduled public defense. Please note that, up until the dissertation defense, the student's Ph.D. committee typically consists of the student's advisor as well as 3 additional faculty members from the department. However, for the Ph.D. defense an additional external committee member is required. The external committee member can be either a faculty member in another department at UToledo or a faculty member at another institution. In the latter case, **the external committee member needs to become a Special Faculty Member of UToledo**. They will need to fill out and submit their CV and the Graduate Faculty Membership Application which can be found on this page with instructions as well: http://www.utoledo.edu/graduate/facultystaff/. (The form itself can be found here https://www.utoledo.edu/graduate/facultystaff/gradcouncil/docs/GradFacultyMembershipApp1.pdf)

Oral Defense of the Ph.D. Dissertation:

The student will present and defend their dissertation in a public defense and answer questions from any member of the audience. (This part of the defense is expected to last roughly 45 minutes.) After the public portion of the defense is concluded, the public is excused from the room. The Ph.D. committee members will question the student about any aspect of the dissertation.

At the end of the examination period, the student's thesis committee asks the student to leave the room to enable conference among the committee members. The committee then provides feedback on whether the student has passed, and what additional measures are required to satisfy the research and dissertation requirement.

The College of Graduate Studies website (http://www.utoledo.edu/graduate/currentstudents/) has all the information you need to setup for your defense and graduate, but useful forms and instructions are spread out over several different pages.

This includes a nice checklist of what is required for graduation both for:

Masters: https://www.utoledo.edu/graduate/files/DegreeCompletionChecklistMasters.pdf
Doctorate: https://www.utoledo.edu/graduate/files/DegreeCompletionChecklistDoctoral.pdf

Pay close attention to deadlines for Graduation Application, Format Review, Defense Acceptance Form & Intellectual Protection Form, and Final Document Submission to OhioLINK with the form under *Important Deadlines* found here:

http://www.utoledo.edu/graduate/currentstudents/thesis_dissertation/

You **DO NOT** need to turn in a physical copy of your dissertation, only an upload to OhioLINK. The UThesis LaTeX template files can be found here:

http://www.utoledo.edu/al/econ/UThesis_Documents.html

Once you apply to graduate, you will be charged **$100** to your account. All fees must be paid or you cannot graduate. Grants are not allowed to be used on this expense. Check your transcript to make sure no PR, IN, or NR grades appear. Directly contact the course instructor if these need to be resolved.

M.S. DEGREE REQUIREMENTS

Introduction

For a degree of M.S. a student must complete at least 30 hours of graduate credit with specific stipulations as mentioned in the catalog. The degree has two options: (i) with a thesis and (ii) without a thesis. The thesis option involves at least 6 credits of research conducted under supervision of a thesis advisor. A thesis written and defended by the student in front of a committee of faculty members is necessary for this option to be completed. In addition to the required coursework, in the non-thesis option, a student must prepare a project report based either on literature research or independent research or a combination thereof, conducted under the supervision of the student's project advisor or co-advisors. The report should be prepared in accordance with the format specified by the advisory committee and the student should present an oral defense of the project results.

REQUIREMENTS FOR THE MASTER'S DEGREE

For the master of science or master of science and education, a student must complete 30 hours of graduate credit that includes the following:

1. PHYS 6140 and an additional 15 hours of graduate course credit in physics, with six of the 15 hours numbered above 6000. Credit in PHYS 5900, PHYS 6010 and/or PHYS 6020 will not count toward either degree.
2. The student must present a satisfactory thesis based on directed research, for no more than eight credit hours.
3. The remaining hours within the 30 total may be chosen from graduate courses approved by the student's committee. In some cases students working toward the Ph.D. may earn the M.S. degree without formal presentation of the M.S. thesis if they have passed the Ph.D. qualifying examination, satisfied the course requirements for the M.S., and completed a research project under the supervision of a research adviser. Students meeting these requirements may petition the department to grant the M.S. without formal presentation of a thesis.

M.S. IN PHYSICS WITH MATERIALS SCIENCE OPTION

A master of science degree in physics with a materials science option is available. For this degree, a student must complete 30 hours of graduate credit, including the following:

1. PHYS 6140, PHYS 6540, PHYS 6550 and an additional 12 hours of graduate course credit in physics with six of the 12 hours numbered above 6000 (no degree credit for PHYS 5900, PHYS 6010 or PHYS 6020).
2. The student must present a satisfactory thesis based on directed research, for no more than eight credit hours.
3. The remaining hours within the 30 total may be chosen from any graduate courses approved by the student's committee.

M.S. IN PHYSICS WITH INTENSIVE COURSEWORK OPTION

1. For the coursework intensive M.S. in Physics the student must complete at least 30 hours of graduate credit including the following:
2. At least 24 hours of graduate course credit in physics, with at least 12 of the 24 hours numbered above 6000 (no degree credit for PHYS5900, PHYS6010, or PHYS6020). No more than 6 hours of graduate research course credit may count towards the 24 hours.
3. In addition to the required coursework, a student must prepare a project report based either on literature or independent research or a combination thereof, conducted under the supervision of the student's project advisor or co-advisors. The report should be prepared in accordance with the format specified by the advisory committee and the student should present an oral defense of the project results.
4. The remaining hours to complete the 30 total required hours may be chosen from any courses approved for graduate credit with the approval of the student's advisory committee.

PSM IN PHOTOVOLTAICS

This degree program is designed for students who want to work in the photovoltaics (PV) industry upon graduation. It prepares master's students with a strong foundation in the fundamentals of PV science and technology. It complements science education through management course work directly relevant to business aspects of manufacturing. It exposes students to a range of research activities on the UToledo campus in laboratories of world-expert faculty in PV. Placement of students as interns in PV manufacturing facilities for six months to enhance their practical training and employability is a critical part of the program. There is no thesis requirement for this degree.

The PSM-PV is designed for students with an undergraduate degree in Physics, Chemistry, an Engineering discipline (e.g. Electrical, Chemical, or Mechanical), or an otherwise related field. For the degree of Professional Science Masters in Photovoltaics, a student must complete 35 hours of graduate credit including the following.

Code	Title	Hours
PHYS 6280	Photovoltaic Materials And Device Physics Laboratory	3
PHYS 6630	Semiconductors I	3
PHYS 6640	Fundamentals of Solar Cells	3
PHYS 6940	Industrial Internship	6
PHYS 6960	M.S. Thesis Research	3-5
PHYS 6990	Independent Study	3
Select two of the following:		6-8

Code	Title	Hours
PHYS 6250	Classical Electrodynamics 1	3
PHYS 6320	Quantum Mechanics 1	3
PHYS 6520	Condensed Matter Physics 1	3
PHYS 6540	Structure, Defects, and Diffusion	4
PHYS 6550	Thermodynamics and Phase Transformations in Condensed Systems	4
PHYS 6980	Special Topics	3
Select two of the following:		6
BUAD 6400	Results-Based Management	3
BUAD 6600	Supply Chain Management	3
CHEE 6010	Green Engineering Principles	3
CIVE 5690	Sustainability Engineering	3
EFSB 6590	New Venture Creation	3
EFSB 6690	Strategic Management of Innovation	3
GNEN 6700	Management of Projects and Technological Innovation	3
INFS 6560	Systems Analysis and Design	3
OSCM 5520	Analysis of Manufacturing and Service Systems	3
PHYS 6980	Special Topics	3

No thesis is required; however, students are expected to make an oral presentation based on research and independent study.

REQUIREMENTS FOR THE MSE IN PHYSICS

The Master of Science and Education is a combined master's degree program offered by the Judith Herb College of Education in collaboration with the College of Natural Sciences and Mathematics. This degree is designed for students who wish to enhance their knowledge in physics and in education. As a general rule, students will have an advisor in the Judith Herb College of Education and in the College of Natural Science and Mathematics who will jointly plan and direct the program. Students who wish to complete their culminating experience in education will work with their Judith Herb College of Education advisor. Students who wish to complete their culminating experience in their sciences field will work with their College of Natural Science and Mathematics advisor.

This program does not lead to a teaching license. Students interested in licensure should apply to one of the Licensure and Master's Programs (LAMP). The MSE is a 36 semester hour program. Students take courses in curriculum and instruction along with courses selected with a physics faculty adviser. The program culminates with a theory and research course and the completion of a master's research seminar, research-based project, or thesis depending on the student's interest. Coursework is completed through a combination of on-campus, online, and field-based courses.

For the Master of Science and Education degree, students must complete the following program requirements:

- A minimum of 36 semester hours of approved graduate course work
- An area of specialization in curriculum and instruction of a minimum of 12 semester hours with courses pre-approved by the faculty advisor
- An area of specialization in Physics of a minimum of 15 semester hours with courses pre-approved by the faculty advisor
- A course to complete the specialization in curriculum and instruction or Physics
- A course in theory and research
- A thesis, project, or research seminar

In addition, no more than six semester hours of credit from any combination of workshops (5950), problems or special topics courses (5980 or 6980), and independent studies (5990 or 6990) may be included in the degree program.

All coursework and requirements of the master's degree must be taken within a six-year period immediately preceding the date the degree is awarded.

A plan of study identifying the courses for the master's degree is required after 12 credit hours, generally at the end of the first semester of full-time study. The master's plan of study must include the following within the 36-semester hour minimum:

- 12 credits of specialization in curriculum and instruction
- 15 credits of specialization in Physics
- 3 credits in curriculum and instruction or Physics
- 3 credits of theory and research
- 3 credits of thesis, project, or research seminar

Ph. D. Degree Requirements

Introduction

The doctoral degree in physics is awarded to a student who has demonstrated mastery in the field of physics and a distinct and superior ability to make substantial contributions to the field. The quality of work and the resourcefulness of the student must be such that the faculty can expect a continuing effort toward the advancement of knowledge and significant achievement in research and related activities. Publication of research in peer-reviewed journals is expected. The doctoral degree in physics prepares students to enter research careers in academic, government and industrial settings. Non-research careers in a variety of areas including public policy, science communication, intellectual property law, and science education are also possible. The degree provides a foundation in either one of the following areas of expertise: astronomy and astrophysics, photovoltaics and condensed-matter physics consisting of theory and experiment, atomic and molecular physics, medical physics, biophysics, photonics. A strong training may be expected in research methodologies and practices, rigorous hypothesis-driven scientific investigation, and the dissemination of research results and ideas through scholarly article publication, presentation at conferences, other universities and research settings. In general, work for the Ph.D. takes five years of study beyond the bachelor's degree. A substantial portion of this time is spent in independent research leading to a dissertation. Normally 90 credit hours of study beyond the bachelor's degree are required for the Ph.D. Students may opt to get a M.S. degree during their Ph.D. program.

REQUIREMENTS FOR THE DOCTORAL PROGRAM

For the doctor of philosophy degree, a student must complete a total of 90 hours of graduate credit including the following:

Code	Title	Hours
PHYS 7220	Classical Mechanics	3
PHYS 7250	Classical Electrodynamics I	3
PHYS 7320	Quantum Mechanics I	3
PHYS 7450	Statistical Mechanics	3
PHYS 8040	Physics and Astronomy Professional Development Seminar	1
Select at least 18 additional hours of credit in physics in courses numbered higher than 6100 approved by the student's committee		18
Dissertation research [1]		30-60
Total Hours		90

Course List

[1] 30 to 60 hours allowed for the dissertation research depending on the nature of the research and the needs of the student.

Credit in PHYS 5900, PHYS 6010/PHYS 8010, PHYS 6020/PHYS 8020, or PHYS 7910 will not count toward degree requirements.

The doctoral degree requirements include a Ph.D. qualifying examination, a comprehensive examination, and a final oral examination. Passing the qualifying examination is a prerequisite for status as a Ph.D. candidate in physics. After passing the qualifying examination, the doctoral student must select a field of specialization. A faculty committee is formed, chaired by the research adviser, to evaluate the student's progress and to establish an appropriate program of course work. This committee administers the oral comprehensive examination, after which only the dissertation research requirement remains. The graduate program ends with the student presenting the dissertation and defending it satisfactorily in an oral examination.

PH.D. IN PHYSICS WITH CONCENTRATION IN ASTROPHYSICS

The Ph.D. in physics with concentration in astrophysics satisfies all the requirements for the Ph.D. in physics while preparing students for a career in astronomy and astrophysics.

To fulfill the requirement of 18 hours of credit in physics courses numbered above 6100, the concentration requires:

Code	Title	Hours
PHYS 6810/7810	Stellar Astrophysics I	3
PHYS 6820/7820	Stellar Astrophysics II	3
PHYS 6830/7830	Galactic Astronomy I	3
PHYS 6840/7840	Galactic Astronomy II	3
Select two related elective courses:		6
PHYS 6710/7710	Atomic Physics	
PHYS 6720/7720	Atomic & Molecular Spectroscopy	
PHYS 8860	General Relativity	
PHYS 8870	Cosmology	
Other appropriate courses		
Select one of the following:		3
PHYS 6980/8980	Special Topics (on an astrophysics-related topic)	
A satisfactory dissertation in astronomy or astrophysics with a supervisor who is a member of the Ritter Astrophysical Research Center.		
Total Hours		**21**

Code	Title	Hours
Course List		

PH.D. IN PHYSICS WITH CONCENTRATION IN MATERIALS SCIENCE

The Ph.D. in physics with concentration in materials science satisfies all the requirements for the Ph.D. in physics while preparing students for a career in materials science.

In addition, the concentration requires:

- Two core courses in the fundamentals of materials science:

Code	Title	Hours
PHYS 8540	Structure, Defects and Diffusion	4
PHYS 8550	Thermodynamics and Phase Transformations in Condensed Systems	4
Total Hours		**8**

Course List

- Two additional elective courses in materials science and engineering chosen from a list of courses approved by the faculty of the Center for Materials Science and Engineering; and
- A dissertation in a materials-related field with a supervisor who is a member of the Center for Materials Science and Engineering.

PH.D. IN PHYSICS WITH CONCENTRATION IN MEDICAL PHYSICS

The Ph.D. in physics with concentration in medical physics satisfies all of the requirements for a Ph.D. in physics degree while preparing students for a career in medical physics. The medical physics-related courses, which total at least 27 credit hours, are provided by the College of Medicine and Life Sciences. The student's faculty advisory committee will consist of faculty members from the department of physics and astronomy and the medical physics fields. The committee may also include other members appropriate for this degree. A dissertation research project is chosen that will have relevance to both physics and medical physics. The Ph.D. requirement of 18 additional credit hours outside the core courses will be satisfied by the specified additional graduate courses in physics and in medical physics.

2022 - 2023 ANNUAL GRADUATE STUDENT PROGRESS REPORT

Name _____Date Reporting _____

Degree _____M.S. _____Ph.D. Adviser _____

_____Date entering UT Physics Graduate Program

_____Date of taking Qualifier _____Date of Passing Qualifier

_____Date of M.S. (Past or Anticipated)*

_____Date of Comprehensive** _____Date of Passing Comprehensive

_____Date of Ph.D. (Anticipated)*

*Note that the M.S. must be completed within 6 years (the Ph.D. within 7 years) after beginning coursework.

**Must be taken within 2 years (counted until the end of the semester of the first attempt of the Qualifying Exam).

Comments on progress toward completing courses required for degree:

Comments on research activities (include any publications, conferences, professional memberships, etc.):

Comments on teaching activities:

Additional comments:

Recommendation regarding assistantship continuation:

Student's goals and likely activities for the upcoming year:

Adviser signature _____ Committee _____

_____

_____

_____

_____

Committee is is not satisfied with student's progress. (please check one)