

Graduate Studies

In

Physics, Astronomy, Engineering Physics

University of Oklahoma

Last Revised: Fall 2018

University of Oklahoma

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Department of Physics and Astronomy

Graduate Student Handbook

**Rules for the pursuit of a graduate degree in
Physics or Engineering Physics**

Revised Fall 2018

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PREFACE

This “Red Book” has been designed by the Graduate Studies Committee to guide you through the various degree programs offered by the Department of Physics and Astronomy at the University of Oklahoma. The fundamental mission of the Department of Physics and Astronomy is to train talented scientists, and in the process produce important research in fundamental and applied physics and astronomy. The rules below were designed with that goal in mind.

This book is by no means a condensation of all University regulations. To obtain a complete listing of all current regulations for graduate students at the University, contact the Graduate College, Robertson Hall, 325-3811 or consult their website, gradweb.ou.edu.

Keep in mind that the rules and guidelines herein are subject to the discretion of the full faculty.

We have tried to prepare this information in as palatable and clear a form as the nature of the materials permits. If you have any questions or suggestions, we would appreciate the input!

WEBSITE ADDRESS

<http://www.nhn.ou.edu>

The Department of Physics and Astronomy maintains an up-to-date website featuring information on departmental research, the colloquium schedule, schedules of seminars and journal clubs, and a comprehensive look at the graduate studies program.

A quick look at the site's index reveals additional online information such as research highlights, copies of this handbook as well as the undergraduate handbook, personnel, facilities, news about the department, etc. Our website is a an important resource for you.

Additional information about the rules and regulations of the University of Oklahoma Graduate College can be found at <http://www.ou.edu/gradweb> .

I. APPLICATION AND ADMISSION

If you are reading this, the assumption is that you have been admitted to the Graduate College at the University of Oklahoma. However, not all admissions are alike: there is standard admission, conditional admission, and admission as a special student. In addition there are some special considerations for international students who are not native speakers of English. (See Sec. VA.)

A. *Standard Admission*

Typically students apply to and are admitted to the doctoral program in Physics in the Graduate College, although some students are admitted to the masters program. Doctoral students who wish to get a masters degree “along the way” as a non-thesis option must also apply to and be admitted to the masters program **the semester before** they intend to take their Qualifying Exams or the General Exam for the admission to candidacy, depending on which exam will be used in lieu of the nonthesis masters exam. *As of 2016, students are admitted simultaneously to the MS and Ph.D. programs, with the expectation that students will gain an MS en route to the doctoral degree.*

B. *Conditional Admission*

Some students may be admitted to the Graduate School *conditionally*. Typically these are either students with an undergraduate GPA between 2.5 and 3.0 or students who have significant gaps in their undergraduate physics education. Their admission letter should specify the exact conditions of their admission (e.g. maintaining a GPA over 3.0 or taking specific courses to address their educational needs). Any such student who does not meet the conditions of their admission may be expelled from the program.

C. *Admission as a Special Student:*

This category applies to any person eligible for admission to the University (as an undergraduate) who wishes to take courses but does not plan to pursue a degree, or who has a bachelor's degree but cannot be admitted to the Graduate College (e.g., because of a low overall grade point average or excessive undergraduate deficiencies).

Work completed as a Special Student will not be counted toward a graduate degree unless the student was eligible for admission to the Graduate College at the time such work was taken, and then only if approved by the Department and the Graduate Dean. However, if a Special Student later decides to apply (or reapply) for admission to the Graduate College, his or her record of performance as a Special Student (e.g., in 3000-4000 level courses) will be taken into consideration in the admission decision.

II. GENERAL INFORMATION FOR ALL GRADUATE STUDENTS

A. *Advising:*

Graduate studies are fundamentally different from undergraduate studies: A graduate program is essentially one of preparation for a profession, much like law or medical school. The transition from student to scientist is a demanding one and does not occur in a vacuum. Initially, you will be advised by the Graduate Studies Committee. In addition, students who want departmental support past their first year can only have it if requested by a faculty mentor, who will help in guiding the student. Once you have determined an area of research you wish to pursue, you should meet faculty in that area and ask if they would act as an advisor. Later, if you are a PhD candidate, the chair of your Doctoral Committee (*i.e.*, your research director) becomes your advisor. The Engineering Physics Graduate Liaison or his designee advises students in the Engineering Physics Program.

B. *Graduate Credit:*

You can receive graduate credit only for courses listed with a "G" before the course number in the current Graduate College catalog. Whether a particular course is acceptable for credit toward the degree on which you are working is determined by the Department and/or your advisory committee, and by the Dean of the Graduate College. No 3000 level courses from the Department of Physics and Astronomy will be accepted for degrees in Physics and Astronomy, and no undergraduate core courses will be accepted for degrees in Engineering Physics. It is possible for students to take advanced undergraduate courses (with a "G" before the course number in the current Graduate College catalog) in Mathematics, Engineering or related fields with the consent of their advisory committee.

C. *Grades and Grade Point Averages:*

You retain your status as a graduate student as long as you fulfill the specific requirements of the department and maintain a 3.0 grade point average on all graduate coursework taken as well as on all course work attempted. All grades obtained in

graduate level courses, whether comprising a part of the degree program or not, will be used in calculating the GPA. Grades of S, U, I, X, P, and NP, for which no grade points are awarded, do not affect your GPA.

If your GPA falls below 3.0, you will be on academic probation for the next 12 credit hours of enrollment. During academic probation, you are not permitted to use advance registration, change programs, take the general exam or hold a dissertation defense. You are required to increase your GPA to 3.0 by earning A's in graduate-level courses. You are also required to improve your GPA in each semester of your 12-hour probationary period or you may be denied further enrollment before the 12-hour period elapses. Earning two or more hours of U will also place you on probation. If you earn any grade of U or NP while on probation, future enrollments will be stopped.

Finally, you must not receive more than two grades of "C" or below no matter what your GPA. This rule only applies to the Ph.D., but not to the MS. *These are Graduate College rules and not internal departmental policy.*

D. Enrollment Limitations:

You must be a full-time graduate student to be eligible for financial support from sources under the control of the Department. Thus, if you are supported as a TA or an RA you must meet the Graduate College criterion for enrollment of 5 hours per Fall/Spring semester. However, if you have not finished your coursework, you are expected to enroll in 9 credit hours (when possible) in the Fall and Spring semesters to expedite your progress towards your degree. Taking fewer courses may jeopardize departmental support. It is not necessary to enroll in the summer if you are holding an assistantship unless you plan to take obtain a degree in that semester (see below). International students should check if their visa requires a minimum number of hours of enrollment.

Students who are not supported by the Department and are enrolled in research hours only (MS research 5980 and PhD research 6980) are required to maintain a continuous enrollment with a minimum of 2 hours of research each fall and spring until the thesis/dissertation defense is held. Summer enrollment is not required unless the student plans to defend during the summer semester.

Enrollment is limited to 16 hours per semester (9 per summer) unless you request additional hours from your advisor and the Graduate Dean. If you have a half-time (0.5 FTE) teaching or research assistantship, you may not take more than 12 hours per semester (6 per summer).

E. Annual Review of Progress:

Every student is to have an annual review of progress toward his/her degree. This typically occurs in the Spring Semester. For first-year students, this interview is conducted by the Graduate Studies Committee. Once the student has an Advisory Committee (see below), which typically becomes the student's Doctoral Committee, that interview will be carried out by that committee. The purpose of the interview is to ensure the student's steady progress toward graduation and to help with any problems that may have arisen since the previous interview. The Advisory/Doctoral Committee will issue a written report on the student's progress to the Graduate Studies Committee once a year.

F. Dismissal of Graduate Students:

Under some circumstances the Department may dismiss a student from his or her graduate program even though that student may have maintained a B average in his or her coursework. Grounds for dismissal include (but are not limited to): failure to adhere to ethical codes of scholarship; failure to obtain a thesis/dissertation advisor; failure to assemble a complete and appropriate Advisory Committee; failure to make timely progress toward the degree; or failure to perform in coursework, Qualifying Exam, or research at an acceptable level for students in the Department.

G. Transfer Credit:

If you have transferred from another graduate school, you may transfer up to 25 percent of the total number of hours required for the MS (8 hours), provided the Graduate College accepts your previous coursework. The number of transfer hours accepted from each doctoral candidate will be individually determined at the Advisory

Conference. The Advisory Committee will write a memo to the Dean of the Graduate College, who has the final authority for approving transfer credits. The maximum allowed by the Graduate College is 44 hours. By transferring coursework you are stating that you have a mastery of that material, which may require you to take the corresponding Qualifying Exam at the next opportunity, with no free attempts.

H. Departmental Colloquia, Journal Clubs, and Seminars:

The Department Colloquia are an important part of the education program, because they provide both students and faculty with the opportunity for contact with researchers in a variety of fields from other parts of the nation and the world. This exposure is a necessary part of the education process, and *students are expected to support the colloquium program and related activities with their attendance.* Furthermore, each research group, Astrophysics, High-Energy Physics, Condensed Matter, and Atomic/Molecular/Optical, has a journal club or seminar that meets on a regular weekly basis. Students working in those fields are expected to regularly participate in the seminars and journal clubs, and faculty advisors are expected to encourage their students to attend.

I. Teaching Practicum:

All PhD students will be required to take an appointment as a Teaching Assistant with a minimum of 2 contact hours per semester for two semesters. This appointment must involve contact with students, through a discussion section, a laboratory section or teaching a class in the summer; a grading assignment would not be acceptable. As a TA, the student will be required to attend the University-sponsored TA instruction workshop, and like our other TAs will receive feedback on his or her teaching methods by having his or her class visited once a semester by the course instructor (see page 31). This practicum is independent of financial support by the Department, either in the form of Graduate Assistantship, Research Assistantship, or Fellowship. (The Advisory Committee, with the concurrence of the Graduate Studies Committee, can modify this requirement in exceptional circumstances.)

This requirement ensures that our PhD graduates have experience in teaching, a valuable skill whether the student pursues an academic or industrial career.

J. Introduction to Research/Teaching Workshop:

All first-year graduate students to our program are required to participate in a course entitled "*Introduction to Graduate Studies.*" This Fall semester workshop/seminar includes both exposure to the research being conducted in the department (through evening Faculty Research Seminars), discussion of ethical and practical issues of being a physics/astronomy graduate student, career directions, and a teaching workshop to improve the skills of new TAs.

III. MASTER'S DEGREE PROGRAMS

The Department offers Master of Science degrees in Physics, Physics with Emphasis in Astronomy, and Engineering Physics. The masters degree may be based on a thesis and its defense, or it may be based on passing the departmental Qualifying Exams or the general exam (which includes giving an oral presentation). In both of these cases, you must be previously enrolled as an MS student.

For those graduating with a terminal MS degree, A *Program of Graduate Work/Admission to Candidacy* form must be filed in the Graduate College no later than the first Monday in March (for summer graduates), the first Monday in April (for fall graduates) and the first Monday in October (for spring graduates). Students should be sure to consult the Graduate College for general Graduate College requirements. In particular, you should note that a maximum of 12 credit hours of 3000 and 4000 level courses might be counted toward a Master's Degree. Details regarding the accumulation of hours and required courses follow.

A. *MS in Physics:*

As of fall 2016, all Ph.D. students are normally admitted concurrently to the MS Program. It is expected that most students will wish to receive an MS degree en route to the Ph.D.

There are two routes to the MS degree in Physics: the thesis option and the non-thesis option. For the thesis program, you must take and pass at least 30 hours of coursework. Of these, at least 18 hours must be Physics and Astronomy courses numbered 4000 or above. These hours must include 2 to 4 hours of Physics 5980 (Research for Master's Thesis), but may not include courses 4153 and 4300. You also have to complete at least 12 hours of other graduate coursework (for a total of 30), which may include 4153 (Statistical Physics and Thermodynamics), and 4300 (two hours of Senior Lab) or their equivalent. Finally, the student must write and defend a Masters thesis. The details of this are described in Section D below.

There are also two ways to obtain a non-thesis Master's Degree in Physics. In both you must take **32** credit hours¹ of graduate courses of which 20 hours are in physics and astronomy courses numbered 4000 or above. (Note that Physics 5980 (Research for Master's Thesis) is not acceptable credit for a non-thesis program.) For students who wish to obtain their Masters “along the way” to their Ph.D. at OU and have passed their Qualifying Exams at the doctoral level, their candidacy or General Exam may also serve as the Nonthesis Exam for the Masters degree. The semester before you expect to take the General Exam, you must apply to be concurrently admitted to the Master’s program, if you are not already so admitted. When you file to become a Ph.D. candidate and fill out the Graduate College’s “General Exam Application for the Doctoral Degree” you should **at the same time** fill out the forms for a non-thesis Masters degree based on the General Exam for the Doctoral Degree. This request for authority to hold this Nonthesis Exam should be sent to the Graduate College at least one week prior to the exam. Since your committee members can only sign that request if they approve your General Exam paper, you must be sure to give it to them at least a week **before** you expect them to sign the request for authority paperwork. If you pass your General Exam, you will be admitted to Ph.D. candidacy. The General Exam may also be used as your non-thesis masters exam if you have previously filed the proper paperwork with the Graduate College. (Alternatively, the Qualifying Exams may be used as your non-thesis master’s exam as explained in the next paragraph).

The second route to obtain the nonthesis MS is by passing all of the Qualifying Exams (Section IVB) minimally at the “Master’s level” and passing all the required coursework. This requirement is available to obtain a terminal MS or to earn an MS along the way toward the PhD. To use the Qualifying Exams as your non-thesis MS exam, you must pass the three core Qualifying Exams and then have a formal non-thesis examination with your master’s thesis committee, which will confirm your mastery of the appropriate physics knowledge. A Program of Study Form for the non-thesis examination must be submitted early in the semester before your non-thesis examination with your committee in order to comply with Graduate College rules that

¹This is not a typographical error. The Graduate College requires that non-thesis Masters degrees consist of at least 32 credit hours of coursework.

require you to apply for the Masters program the semester before you take the non-thesis Master's exam.

Please note all Graduate College deadlines for what must be completed to receive a degree in a given semester. The Graduate College might not choose to grant Masters degrees that are requested retroactively by students who simply did not fill out the appropriate paperwork before their candidacy exams. Observance of the deadlines for the Masters degree process will greatly simplify the degree process.

B. MS in Physics with Emphasis in Astronomy:

A thesis is required for this degree. You must complete at least 18 hours of Physics and Astronomy courses numbered 4000 and above. These hours must include 2 to 4 hours of Physics 5980 (Research for Master's Thesis) and at least 6 hours of astronomy courses, but may not include course ASTR 4303 (Stellar Astrophysics).

You also have to complete at least 12 hours of other graduate coursework, which may include Astr 4303.

However, astrophysics students can also obtain a nonthesis Masters in physics by following the rules stated in Sec. A above. The degree will simply not refer to Astronomy.

C. MS in Engineering Physics:

The Master of Science in Engineering Physics degree is offered as either a thesis program or a non-thesis program. The non-thesis program requires satisfactory completion of 32 hours (excluding 5980) of graduate study comprised of a minimum of 12 hours of Physics and 12 hours of engineering courses. You will have to take and pass the Physics PhD Qualifying Exam (see Section IVB).

The thesis program requires the completion of 30 hours of graduate credit including a research thesis on some topic of applied science. You must take 2 to 4 credit hours of 5980 (Research for Master's Thesis) as part of your program. If your research director is from Engineering, a minimum of 12 hours of Physics and 9 hours of Engineering is required; if your research director is from Physics, a minimum of 9 hours of Physics and 12 hours of Engineering is required.

The Engineering Physics Chair or a duly appointed representative must approve all programs of graduate study. (Note that you cannot receive graduate credit for any course equivalent to one required in the undergraduate Engineering Physics program.)

If you are a physics student and wish to take an MS in Engineering Physics, you must be admitted the semester before taking the exams to the Engineering Physics program. For a nonthesis degree, your Nonthesis Examination (either the Qualifying Exam or the General Exam) must be approved by the head of Engineering Physics.

D. Master's Thesis (Applies to any of the above thesis programs):

There are four major fields of research in the department (Astrophysics, Atomic and Molecular Physics, Condensed Matter Physics, and Particle Physics). You are responsible for choosing a research field and finding a faculty member in that group to direct your research. The Department's Graduate Brochure and its web site contain descriptions of the research interests of the faculty and should be useful first sources of information. In addition, we encourage you to talk with potential research advisors in several fields before selecting a research area. To aid in the selection of an advisor, the Department offers an "Introduction to Graduate Studies" seminar, which includes faculty presentations (Faculty Research Seminars), required of all new students.

When you have selected a research problem and obtained a faculty research director, you must inform the Graduate Studies Chair. During the semester in which you first enroll in 5980 thesis research, you must fill out a Program of Study and an *Application for Approval of the Master's Thesis Topic and Committee Membership* form, which you obtain from the Graduate College. All members of your committee and the Graduate Studies Chair (graduate liaison) must sign this form, which you will return to the Graduate College.

A masters thesis typically takes 18 months to research and write. Your thesis must detail tangible results from a personally conducted research investigation. After a draft of the thesis has been prepared which meets with the approval of your research director, you must present reading copies to 2 other members of the faculty who have previously agreed to serve on your MS committee. This reading copy must be provided at least two weeks before the defense. (Note that you cannot prepare the final form of

the thesis and submit it to the Graduate College until all your committee members have read and approved a preliminary form.) Please check the Graduate College for the dates that forms must be submitted to graduate in a given semester.

This Department does not require a final written exam for a thesis based Master's Degree; however, a thesis defense is required by the Graduate College. (Submit the *Request for Authority for Thesis Defense* to the Graduate College when a reading copy of the thesis is presented.)

E. Master of Natural Science Program:

Physics is one of the eight fields that may be used to meet the requirements of the degree of Master of Natural Science. This degree program is designed for students interested in teaching science in the secondary school systems. There are no detailed Physics requirements. See the Graduate College Catalog for details.

IV. DOCTORAL PROGRAMS

A. Physics and Astronomy Course and Hour Requirements

The minimum of 90 hours or more of graduate credit must include the following core courses:

5000 - Intro. to Grad. Studies	5393 - Quantum Mechanics I
5013 – Math. Methods in Physics	5403 - Quantum Mechanics II
5153 - Classical Mechanics	5573 - Electrodynamics I
5163 - Statistical Mechanics	5583 - Electrodynamics II

In addition to the above 21 hours, you must complete 15 hours of other Physics and Astronomy courses, selected from the list below, which are relevant to the degree specialty that you are pursuing (Physics or Astronomy), or in related fields at the 4000 level and above if approved by the advisory committee and the graduate liaison.

Physics PhD:

5213 Nuclear and Particle Physics
5243 Solid State Physics
5323 Optics
5813 Atomic and Molecular Physics
5970 Seminar in Physics
6213 Advanced Particle Physics
6243 Adv. Solid State Physics
6283 Adv. Atomic/Molecular Physics
6333 General Relativity
6433 Quantum Field Theory
6443 Advanced Quantum Field Theory
6860 Advanced Math. Methods

Physics (Astronomy) PhD:

A4303 Stellar Astrophysics
A5403 High-Energy Astrophysics
A5443 Galactic Astronomy
A5453 Extragalactic Astro.&
Cosmology
A5463 Stellar Atmospheres
A5473 Stellar Interiors
A5513 Interstellar Medium
A5523 Adv. Observatory Methods
A5900 Special Topics in Astrophysics

Other specialized courses may be offered from time to time. They, as well as courses outside the department, may be counted as part of your 15 hours at the discretion of your advisory committee and the Graduate Studies Chair.

The remaining 54 credit hours may be a mixture of formal coursework, seminar courses, special studies (5990), and research for the doctor's dissertation (6980). Other appropriate 4000, 5000, or 6000 level courses in mathematics, chemistry, or

engineering may also be chosen with your committee's approval. Note: no more than 16 hours of 4000 level credit may be applied to the PhD degree (no more than 12 in Physics or Astronomy). In addition to an overall GPA of 3.0, candidates for the PhD degree in Physics and Astronomy must receive a grade of B or better in the required core courses: 5013, 5153, 5163, 5393, 5403, 5573, and 5583. No more than two grades of C or lower are permitted for doctoral students. The Graduate College restricts the number of hours of Special Studies that can be applied to a Ph.D.; currently it is limited to 10 credit hours.

Additional course requirements that are appropriate to your area of research specialization may be determined and required by your Advisory Committee (see page 23). Note: No 3000 level courses from the Department of Physics and Astronomy are acceptable for graduate credit.

In Appendix C (p. 44), we show the "optimal" sequence of courses to be taken during the first two years. Following this sequence will enable the well-prepared student to pass the Qualifying Exam after the first year of study.

All PhD candidates should take note of the following Graduate College rule regarding enrollment in 6980 (Research for Doctoral Dissertation): Following your initial enrollment in 6980, which may be for as little as two hours, you must maintain continuous enrollment during each regular semester (e.g. not intersession or summer) of at least two hours until the requirements for the degree are completed. However, if you intend to graduate in the summer, you must enroll for that summer semester.

B. Physics Qualifying Exams:

The Qualifying Exams (Qualifiers) are a departmental requirement. You do not need Graduate College approval to take any of these exams. This can cause confusion because they are *not* the same as the "General Examination" required by the Graduate College (see below). However, if you wish to get an MS on the basis of the Qualifiers, you must have permission from the Graduate College, and be admitted to the MS program, as explained in Sec. IIIA.

The Qualifying Exams will be given twice each year, once during the week prior to the beginning of classes for the Fall semester, and again in January prior to Spring

classes. They are scheduled for 5 hours per day for three or four consecutive days. Three of the exams will cover 1) classical and statistical mechanics, 2) electrodynamics, and 3) quantum mechanics (one subject per day). Both physics and astrophysics students take these first three exam sections, which cover graduate and undergraduate material. Astrophysics students must take an additional fourth exam covering their field. The exams are 2/3 advanced undergraduate material and 1/3 graduate material. Sample exams are available from the departmental website. Only students with a declared astrophysics emphasis and an astrophysics advisor/mentor are eligible to take the astrophysics Qualifying Exam (unless it is the student's free attempt). Criteria for passing the Qualifying Exams is described in the Homer L Dodge Department of Physics and Astronomy Faculty Procedures and Policies Manual (The Blue Book) and summarized here. To pass a Qualifying Exam at the Ph.D. level a student must pass half the problems (defined as earning at least 50% of the points on the problem) and also earn at least 50% of the total available points on the exam. A student will fail the exam at the Ph.D level by failing more than 60% of the problems on the exam. To pass at the Master's level a student must pass half the problems and also earn at least 40% of the total available points on the exam. Minor variations of these criteria may be made by a majority vote of the faculty.

The rules governing when students must take the Qualifiers are designed to help students move on to research in a quick but deliberate fashion. They are:

1. No student will be required to take more than two Qualifiers a semester.
2. Students in general are not required to take any Qualifiers their first year (typically the Fall they arrive and the Spring of their second semester). They are encouraged to take the exams, and can have one attempt ("freebie") on each of the exams during this first year which will not count against them if they fail. **However**, students who are claiming graduate transfer credit for one of the core graduate courses (listed in point 3 below) are claiming graduate proficiency in that subject area. They must start taking the relevant Qualifiers after their first semester and have no such free attempts in that subject area.
3. After their first year, students must take those exams for which they have taken the relevant courses:

- Quantum Mechanics I (5393) ⇒ Quantum Exam
- Classical Mechanics (5153) and Statistical Mechanics (5163) ⇒ Classical and Statistical Mechanics exam
- Electrodynamics I (5573) ⇒ Electrodynamics exam

There is no such requirement for when Astrophysics students must take the Astrophysics Qualifier other than point (4) below.

4. All degree candidates must have attempted each of the Qualifying Exams by the start of their fifth semester with the astrophysics students attempting the astronomy Qualifier as well.

Failure by the student to take a section of the exam when he or she is otherwise qualified to do so counts as one unsuccessful attempt of that section (unless you have a petitioned exemption). A student, who fails any part of the Qualifiers twice, in general will have failed the graduate program.

Students can petition the faculty for a third attempt on a Qualifying Exam. The petition is made by submitting a letter early in the semester following the failed attempt to the Graduate Studies Committee explaining why a third attempt is warranted. It must be accompanied by a supporting letter from the student's faculty mentor further justifying the merits of the petition. Third attempts are not automatic, and will be judged upon the student's performance in courses, Qualifying Exams, and research as well as general promise for obtaining a Ph.D. Petitions from students who have been in the program for more than 4 semesters will be heavily weighted on the promise they demonstrate in performing research that can lead to their dissertation. The petition and supporting letter will be reviewed by the Graduate Studies Committee and passed along to the faculty with a recommendation of whether or not to approve the petition. The final decision is made by a vote of the faculty. Petitions filed after November 1, for a second failure on the August Qualifier, or April 1, for a second failure on the January Qualifier, will not be considered.

A list of specific references, and previous Qualifying Exams, are posted on the Departmental Qualifying Exam website in order to help you organize your study for the exam. A committee of faculty members, the chair of which will usually be a member of the Graduate Studies Committee, constructs the exam. The exam will be made up of

questions submitted by the faculty, but it will be the committee's responsibility with input from the Graduate Studies Committee to see that broad coverage in each area is maintained.

The faculty may, in exceptional circumstances, vote to pass a student on a particular Qualifier exam “with deficiency.” In this case, the student may be given a special oral exam (as described in Sec. C below), or such other requirement that the faculty sees fit to impose.

C. Special Oral Qualifier:

This is not a petitionable option for the student; rather the faculty votes (at the Qualifier meeting) to determine which students are awarded Qualifier passes, contingent upon passing the special oral Qualifier. A simple majority wins. The faculty may vote to deny the oral exam option, in which case the student may still petition for a third attempt.

Four oral examiners will give each exam. One non-voting member shall be the advisor or advocate of the student. The Graduate Studies Committee will select three other examiners appropriate to the subject matter.

The oral exam should occur within two months, but not less than one month, after the written exam, unless the student agrees to an earlier date.

The exam itself will be confined to the materials of the deficient subject at both the undergraduate and first year graduate level and will use the previous Qualifier as a starting point. Questions at the level of difficulty of the written exam will be expected. The format of the exam is the choice of the examiners; however, it is expected that the exam should take approximately one hour and no more than two.

A majority of the examiners must vote in favor of the student in order for the student to pass. If the student fails the oral exam, he or she may still petition for a third attempt, if one has not already been granted.

D. Advisory Conference:

In your second year, you must select an Advisory Committee and have your Advisory Conference and submit your Advisory Conference Report/Program

of Study. Failure to do so by the end of your second year could jeopardize your eligibility for tuition waivers in your third year. This limitation on eligibility for tuition waivers reflects a Graduate College rule.

Before selection of an Advisory Committee, you need to discuss your prospective research with your research director. Together you contact *four additional faculty members (including one from outside the Department)* who must be a member of the graduate faculty and will serve on your Advisory Committee. At least one of the departmental committee members should be from a different research group than that of the student's advisor. Any additional committee members from outside OU must be approved by the Dean of the Graduate College.

The purpose of your Advisory Committee is to help you formulate an overall plan of work for your doctor's degree. Your previous graduate record will be examined to determine the future courses you need to take. The Committee's standard of judgment will be a well-balanced program suitable to your background, and will take into consideration both your educational and professional needs.

The *Report of Advisory Conference* sets the specific personalized course requirements for your degree program. This report (a form for which can be obtained from the Graduate College web site) must be signed by all members of your Advisory Committee and by the Chair of the Graduate Studies Committee, then submitted to the Graduate Dean for approval. (If any changes in the *Report of Advisory Conference* or in the membership of the permanent Doctoral Committee become necessary, a *Request for Change in Doctoral Advisory Conference Report* form, approved by the original committee holding the Advisory Conference, must be filed with and approved by the Graduate Dean.) Any requests for transfer credit for courses taken prior to entrance at OU should be made at the time of the Advisory conference in the form of a petition to the Dean of the Graduate College.

E. Doctoral Committee:

In most cases, the Advisory Committee later becomes the Doctoral Committee. In any case your Doctoral Committee membership follows the same rules as your Advisory Committee: it should consist of your advisor and four other faculty members

(including one from outside the Department) who must be a member of the graduate faculty. At least one of the departmental committee members should be from a different research group than that of your advisor. Your Doctoral Committee will supervise the preparation of your dissertation and conduct the final oral defense of your dissertation. Members of your Doctoral Committee will also help and encourage you throughout your career as a doctoral candidate.

F. Annual Evaluation of Doctoral Students:

The appropriate Advisory or Doctoral Committee shall evaluate annually each Ph.D. student who has passed the Qualifying Exams and has had his or her advisory conference. The Committee shall conduct this evaluation as an informal interview of the Candidate. This annual interview replaces the interview by the Graduate Studies Committee. The results of the evaluation shall be transmitted to the Graduate Studies Committee, and will form the basis of the yearly summary evaluation letter given to the student and placed in the student's file by the Chair of the Graduate Studies Committee.

G. General Examination:

A General Examination for the Ph.D. degree is required by the Graduate College. That examination must consist of two parts, a written and an oral exam. In the Department of Physics and Astronomy, the written portion consists of a critical review of the subject to be discussed in an oral presentation or candidacy exam. This exam tests your competence in an area of special interest to you as well as your general background in physics. Your topic can be part of your dissertation research, for example, your first research project. In short, it is an exam to test that you have the skills needed to complete a substantial research project. *The General Exam must be completed no later than the fall semester of the student's fourth year.* A student may not schedule the General Exam until all three physics Qualifying Exams have been passed for non-astrophysics students, and all four Qualifying Exams have been passed by Astrophysics students.

When you are ready to take your General Exam, obtain an application for taking the General Examination at the Graduate College web site. Two weeks before

requesting authority for the exam (that is, four weeks before the oral exam), you must supply the committee with a 10-20 page report complete with references to the literature. Approval of the report will constitute passing the written portion of the General Examination. The request for authority to hold the oral portion of your General Exam should be signed by your Advisory Committee and returned to the Graduate College at least 2 weeks before the exam is scheduled. The Graduate Dean will normally approve the request if it is in order and if you have an overall grade point average of 3.0 or higher. The Dean will then appoint a committee to conduct the examination (usually it will be your Advisory Committee) and notify you and the committee chair of his approval. If he wishes, the Dean may send a representative of the Graduate College to attend the examination. **You** must notify all members of the committee of the time and place of this exam, as well as publicize the exam to the department so that others may attend. To reiterate, the report to your committee must be submitted 4 weeks before the oral exam.

For the oral part of the General Exam, you should present a discussion of your chosen topic. This is a public discussion and should be advertised to the department by email several days before it is held. This part of the exam should be limited to 50 minutes. Following your presentation, the committee will question you (orally) on topics and principles used in or related to the previous discussion. In addition, you may be questioned by your committee on some general principles of physics.

Ideally all members of the committee should be physically present at the General Exam. The student, the committee chair, and the outside member must be physically present at a minimum. Other committee members may participate remotely by audio or video conferencing. The exam may be held with one departmental member absent only if the graduate dean gives prior permission. However, the OU faculty member who is external to the Physics and Astronomy department **must** be present. When the exam is completed, the Committee Chair submits a report to the Graduate College. The report will contain a statement of the results of both the written and oral parts of the General Exam. If you have passed, the Graduate Dean will admit you to candidacy for the Ph.D. degree.

A minimum of four signatures must be on the report. The Dean of the Graduate College, who will then make the final decision, will review any report with dissenting votes. If you fail this exam, you may repeat it once (during the next semester) at the discretion of your committee. Note that if this meeting also serves as a Masters Exam, then failure will result in expulsion from the Graduate College.

H. Doctoral Dissertation:

After you have passed the General Exam, most of your time will be devoted to research and writing the dissertation. Aided by your research director, you should promptly select a dissertation topic. At this point, you start taking 6980 (Research for Doctor's Dissertation). You must enroll in 6980 during each subsequent semester *for at least 2 hours* until you receive your degree. You need not enroll in the summer if you are not planning on graduating over the summer.

Finding a research advisor and a research topic is the responsibility of the student. It is to be stressed that completing and defending the results of an original research project is considered the most important part of the Ph.D. program. The student can expect this research project to take from 2 to 4 years of intensive work after completion of formal coursework. The Graduate College rules state that a student has five years to complete their doctorate after passing their General Examination.

Your dissertation shall be a complete discussion, including background material, of a substantial, original piece of research that *you* have conducted. The work described in the dissertation should constitute a significant contribution to knowledge, and in the view of the doctoral committee, should be publishable in a refereed journal in the field. Instructions for the formatting of the dissertation are available at <http://ou.edu/gradweb>.

Graduate College guidelines state that your committee must be given a reading copy of the thesis which has been vetted by your advisor one month before your intended defense date. The intent is that the committee must approve the written thesis before you proceed. Faculty are encouraged to return revisions to the student two weeks before the defense date, so that the revisions can be incorporated into the final version of the dissertation.

I. Final Examination:

After successfully completing your research and writing it up, you must prepare to defend your dissertation. Authority to hold a thesis defense must be given by the Graduate College. However, you must complete an online degree check at <http://ou.edu/gradweb> at least two weeks **before** submitting a *Request for Authority for Dissertation Defense* form to the Graduate College (i.e., at least four weeks prior to the defense date). This check makes sure that you have met all the course requirements for the degree and that you are in good academic standing.

When you, your advisor, and your committee are ready for your defense to proceed, you must submit a *Request for Authority* form signed by your research advisor and the graduate liaison (i.e. chair of the Graduate Studies Committee).

The Graduate Dean will then direct the other members of your Doctoral Committee to hold your doctoral exam. This final oral exam for the doctor's degree is a defense of your dissertation and is open to the public. (You should send out an email to the department advertising your defense.) The student, committee chair, and outside member must be physically present at the same location. Other committee members may participate remotely by audio or video conference. The Graduate College must be notified of remote participation before the defense. One member of the committee, other than the chair or the outside member, may be absent with permission of the Graduate Dean. (The Graduate College has rules for handling teleconferencing committee members and related issues; please consult the Graduate College Bulletin for details.) After your presentation and answering questions, the committee will vote whether accept or reject your thesis. If they accept it, they may request minor changes or corrections be made. You should budget time to allow for making such changes in your dissertation.

Within 72 hours after the exam, the chair of the committee will report the decision of the committee to the Graduate Dean. The defense must take place by the last day of classes in order to receive the degree that semester. Once the thesis has been successfully defended, the student must schedule an appointment to deliver two originally signed, unbound copies of the thesis on white, 20-pound to 24-pound weight, 100-percent-watermarked cotton paper to the Graduate College. These copies must be

delivered in person to the Graduate College for a final check within 60 days of the defense. You also must also deposit an electronic copy on ShareOK. For the latest rules and regulations, see the Graduate College Bulletin.

Note: There is a caveat to the Graduate College rules for submission of the dissertation. These rules are only to assure that you will be listed as receiving your degree in the particular semester. In fact, you may complete your dissertation and take your final orals anytime, and you will be certified as having completed the degree. If you miss the Graduate College deadlines, you will be listed as formally receiving the degree the following semester, but you need not be enrolled or in residence during that semester.

J. Doctoral Degrees in Engineering Physics:

To earn a Ph.D. in the Engineering Physics Program (Doctor of Philosophy in Engineering and Applied Science) you must satisfy the general requirements of the Graduate College and the College of Engineering, in addition to the course requirement for a physics Ph.D. Other course requirements specific to your degree program are determined by your Advisory Committee, which is assigned at the time you enter the program. It is therefore important that the Chair of Engineering Physics (or a designated alternate) advise you before entering the program in order that an Advisory Committee is assigned and your program of coursework determined. The requirements for an Engineering Physics Ph.D. have been recently simplified; see the Chair of Engineering Physics for details.

All students wishing to work for a Ph.D. in the Engineering Physics program must pass the Physics Qualifying Exams. See Section IVB for rules governing this exam.

V. FINANCIAL SUPPORT

A. *Teaching and Research Assistantships:*

Most full-time graduate students in the Department receive some form of financial support if they desire it – either as a teaching assistant (TA) or research assistant (RA). Additionally, one or more Dodge Fellowships (with no teaching duties) and one Lin Fellowship (appointed as a TA) are usually awarded each year. Other Graduate Fellowships may also be available. If you were admitted without support and do well in your first semester of coursework, you should see the Chair of the Graduate Studies Committee about the possible availability of an assistantship during a subsequent semester. Supported students, whether on an RA or TA, **must** be enrolled in at least 5 credit hours in every Fall or Spring semester during which they are supported.

International students and others whose native language is not English receive a stipend reduced by \$200/month until they pass the University's English language requirements; half the stipend increase occurs when the B level is achieved, and balance when the language requirement is passed at the A level, so the student can be a full-fledged TA.

TA's are usually awarded for 10 months (i.e., Fall and Spring semesters) on the basis of your academic progress, as evaluated by the Graduate Studies Committee, and your performance and promise as a teacher. The average teaching assistantship requires 10-12 hours of work per week.

No graduate student will be appointed to teaching duties in excess of 0.50 FTE (half time) during a regular semester except where there is a clear and unusual need. Proposals for such exceptions should be discussed in advance with the Graduate Dean and (perhaps) the Provost.

Students holding teaching assistantships are expected to take their duties seriously and perform them conscientiously. For all TAs new to teaching at OU, there is a four-day University sponsored All-Teaching Assistant Training Program offered each August. All new graduate students (including those who entered during the previous spring or summer semesters) receiving departmental support in Physics, Astronomy,

and Engineering Physics are required to attend the first day's general orientation to the University of Oklahoma. There are a variety of sessions in the following days to help prepare TAs for teaching and other student-contact duties. Skill areas include lecturing, leading discussions, and handling classroom problems. Some of these topics are covered in the Introduction to Graduate Studies workshop held during the first semester in residence, so participation in this satisfies some of these requirements.

In addition, for TAs whose native language is not English, there is a five-day workshop held each August, before the beginning of the fall semester. All international TAs new to teaching at OU, including those who have worked as TAs at other American universities, are required to take this workshop. One of the aims of the workshop is to examine cultural differences; the workshop will assist you in dealing effectively with such differences. In addition, the workshop will help you to cultivate your English speaking skills and interpersonal relationship skills. In order to be eligible for classroom teaching, international TAs must pass both written and oral examinations in English. Times and dates for these exams may be obtained from the Graduate Program Coordinator or the English Assessment Program (EAP) office located in Robertson Hall, room 201. *We expect international students holding TAs to pass both written and oral exams before the beginning of their second year.* See Appendix E for more detail.

Note carefully that to retain your TA you must meet the requirements of the Graduate College regarding minimum enrollment and grade point average (3.0 minimum). However, your assistantship can be withdrawn if you fail to make satisfactory progress towards your degree or perform unsatisfactorily as a teacher. (Generally, if the Graduate Studies Committee decides to consider withdrawing your TA, you will be notified one semester in advance that you are in jeopardy, save in cases of malfeasance where termination may be immediate.) If your TA duties require contact with students, your teaching skills will be evaluated each semester by the professor in charge of the course. This evaluation will be made available to you to help you improve your teaching skills.

It is to be stressed that the continued awarding of financial support in the form of TAs or RAs is dependent on progress toward the degree. These assistantships are not just jobs where you are paid for services rendered, but are primarily intended to aid you

in your pursuit of an advanced degree. Satisfactory performance as a TA or RA is a necessary, but far from sufficient, condition for retention. It is expected that an RA or TA position, combined with graduate studies, will not allow the serious student any time for additional external employment. Moreover, it is often the case for international students that visa requirements prohibit outside employment. It is the policy of the department that no student supported by the department, either in the form of a TA or RA shall have employment outside the department. Please consult the Chair of the Graduate Studies Committee if you have any questions about this policy.

Usually a few summer TAs are available. If you want to apply for one of these, be sure to tell the chair of the Graduate Studies Committee **well before the end of Spring semester**.

You should switch from a TA to an RA if circumstances permit. For example, your research director may pay you for your work on research if he or she has an externally funded grant to support his or her work. Stipends for RAs are expected to be somewhat higher than for TA's.

Graduate assistantship stipends are divided up into 5 payments per semester (except summer sessions). If you are to be appointed for the academic year beginning in the fall, you will be appointed effective August 1. You will be paid (usually by electronic direct deposit) on the last working day of August, and it will be for one-tenth of your total annual stipend (less taxes, etc.). You are not required to *work* beginning August 1, but you should be here well before the beginning of classes (TA workshops and Qualifying Exams are held 1-3 weeks before classes begin). New students should check their letter of admission which details workshops and other details that may require an early arrival on campus. If your assistantship is for the whole academic year, then you will receive 10 checks, each for one-tenth of your total stipend, and your last check for that stipend will be issued on the last working day of May. Summer appointments are separate.

B. Financial Support Policy

Progress towards degree will be the primary, but not sole, criterion used by the Department of Physics and Astronomy in determining whether a graduate student in Physics, Astronomy, or Engineering Physics is eligible to receive financial support from department funds in the form of teaching assistantships and research assistantships. (Progress towards degree includes academic progress, performance, and ability as demonstrated in coursework, the Qualifying Exam, the specialist's exam, teaching ability, and research.)

Students in the PhD degree program that demonstrate satisfactory progress towards their degree will be eligible for financial support from department funds during the first two full semesters (fall and/or spring semesters) of graduate work. Students in a terminal master's degree program will be considered for financial support from department funds, but at a lower level of priority than PhD students. This does not exclude a student seeking a terminal master's degree from receiving financial support from the department. This only states that PhD students will be considered first for this form of support. Masters students who do receive support will be eligible to receive such support during their first two full semesters if they demonstrate satisfactory academic merit.

After this initial period of support (i.e., two semesters) a student demonstrating satisfactory academic merit receives additional financial support from department funds in the form of assistantships only at the request of a faculty mentor. *The goal of this policy is to get students involved in research as soon as possible.* This mentor must be a faculty member or adjunct faculty member of the Department of Physics and Astronomy. After the initial period of financial support, a student whose research advisor is not a faculty member or adjunct faculty member in the department is expected to be supported by funds provided by the research advisor, and thus is not eligible to receive financial support from department funds. Master's degree candidates following the non-thesis option, however, may be supported by department funds past their second semester of graduate study at the discretion of the Graduate Studies Committee.

This financial support policy will apply to all teaching and research assistantships funded by the Department of Physics and Astronomy. Fellowships, research assistantships funded by external grants, and assistantships administered by the Engineering Physics Program, may be awarded using other criteria.

C. Stipend Increases

As an incentive to progress through the program, the Department offers steps in stipends for TAs when the following milestones are achieved:

- 1) For international students, when they become qualified to teach students as determined by the EAP office at least at the B level. To receive the full stipend increase, passing at the A level is required.
- 2) For PhD students, when all parts of the Qualifying Exams are passed.
- 3) For PhD students, when the General Examination is passed and they are advanced to candidacy.

The stipend increases take effect the semester following that in which the milestone is achieved.

D. Graduate College Tuition Waiver Program

All full-time graduate students in academic good standing - who are not residents of Oklahoma - who receive a half time (0.50 FTE) departmental appointment either as a TA or RA and are working toward a degree program in Physics, Astronomy or Engineering Physics, are eligible for non-resident tuition waivers from the Graduate College.

All full-time graduate students in academic good standing - U.S. citizens as well as international students - who receive a half time (0.50 FTE) departmental appointment either as a TA or RA and are working toward a degree program in Physics, Astronomy or Engineering Physics, are eligible for an in-state tuition waiver for a maximum total of 90 credit hours over their entire studies. (In addition to tuition are fees, which cannot be waived by state law, and therefore must be paid by the student.) The Graduate College will **only grant 90 hours of tuition waivers** to a doctoral student which covers the 90 credit hours required to get a doctorate (and 30 or 32 for masters students). Thus if you

take courses that cannot be applied towards your degree, they will end up costing you personally in tuition.

E. Student Health Plan

The University of Oklahoma offers a Student Health Plan to all graduate students enrolled in five or more credit hours each semester or enrolled in thesis/dissertation hours. Students appointed ½ time or more as a graduate teaching or research assistant may sign up for health coverage of \$50,000 at no charge. This is a benefit of employment. A \$1,000,000 plan is also available by paying an additional cost above the subsidy amount. Detailed information on the plan is available from the Norman Campus Goddard Health Center, 620 Elm Avenue.

VI. NIELSEN HALL

A. Building and Lab Access, Study Areas, Keys:

New graduate students who would like a desk in Nielsen Hall for personal study should see the Assistant to the Department Chair in the main office. If you are a TA, a desk will be assigned to you. See the Assistant to the Department Chair for this assignment.

Also, see the Assistant to the Department Chair for whatever keys you may need. You will need keys, which permit evening or weekend access to the building, to your study area and/or lab. If your research requires the use of a departmentally controlled room after hours, you may obtain keys with the permission of your research advisor *and* the Chair of the Department.

B. General Safety Procedures:

While you are carrying out your research, you will be responsible for using equipment and conducting experiments safely. You should talk with your research advisor and fellow students about the innumerable hazards associated with the use of high voltages, radioactive materials, lasers, high pressures, inflammable and cryogenic liquids, etc. Fire extinguishers are located on every floor as well as fire alarms. Familiarize yourself with their locations! All users of computers, electronics, and other research resources are responsible for care and maintenance of the equipment. Online safety training is required for all students, staff, and faculty.

C. Student Shop:

If you want to use the student shop, it is mandatory to take the shop course that is offered in the summer.

D. Computing:

The department possesses a rapidly growing network of workstations and PCs. The Nielsen Hall Network is part of the campus network, and accounts may be obtained on other University computers. The university hosts the OSCER supercomputing center; the high-energy group's rapidly expanding grid-computing network is part of this center. Access to the world is available via Internet. Your research advisor and the Computer Systems Manager (CSM) can assist you in meeting your computing needs.

The University sets up e-mail accounts when a student is initially admitted. The department uses e-mail on a regular basis to contact graduate students, individually and as a group, about upcoming programs, job opportunities, etc. New graduate students should contact the CSM as soon as possible to set up an e-mail alias or account so that messages can be received via the department's internal group aliases. It may be advantageous to have an account on the departmental system.

We hope your time with us is educational and fruitful. Good Luck!

APPENDICES

APPENDIX A

Quick guide to steps in MS programs in Physics, Astronomy, and Engineering Physics

I. Physics Masters

A. Non-thesis Track

- 1) Enroll in Physics MS program. You must be enrolled at least the semester **before** you apply for the degree. If you are a doctoral student getting a Masters “along the way” to your doctorate **you still must enroll in the Physics MS program**. As of fall 2016, this enrollment will normally be automatic for new Ph.D. students.
- 2) Complete 32 hours of appropriate graduate coursework. Your GPA must be above 3.00.
 1. Twenty of those hours must be Physics and Astronomy department courses number 4000 and above (excluding PHYS 5980).
 2. The remaining 12 can be taken from other departments only if they are listed with a G before the course number.
 3. No more than 12 credit hours can be below the 5000 level.
 4. Your committee may ultimately allow substitutions of equivalent courses. Up to 8 hours of previous graduate work may be transferred.
- 3) Submit Program of Study for the MS degree the semester before completing the nonthesis exam. (The deadline for the paperwork to be submitted to the graduate college is the first Monday in April for Fall, the first Monday in October for Spring, and the first Monday in March for Summer).
- 4) Pass Physics PhD Qualifying Exams at least at the master’s level and take the non-thesis exam which consists of a meeting with your advisory committee confirming your mastery of physics knowledge. This can constitute nonthesis exam if permission to take this exam is secured from the Graduate College in advance.

- 5) Graduate liaison requests *Authority Report Form of the Non-thesis Examination* from the Graduate College which is signed and submitted by examination committee within one week after exam decisions are made.
- 6) Alternatively, the student may use the General exam as the nonthesis exam for the MS.
- 7) Students passing the exam are awarded a degree. Students failing may be allowed one additional attempt by petitioning the Graduate College. If the student fails the exam a second time, the student will not be allowed to continue in the graduate program.

B. Thesis Track

1. Enroll in Physics MS program.
2. Complete 30 hours of appropriate graduate coursework with GPA of 3.0 or better.
 - a. These must include 18 hours of graduate courses in Physics and Astronomy, excluding PHYS 4153 and PHYS 4300.
 - b. Included in these 30 you must have 2-4 credit hours of Research for Master's Thesis (Physics 5980); these can count towards the above 18.
 - c. The remaining 12 credit hours may include PHYS 4153 and PHYS 4300, and may be taken from other departments if they are listed with a G before the course number.
 - d. No more than 12 credit hours can be below the 5000 level.
 - e. Your committee may ultimately allow substitutions of equivalent courses.
3. Arrange for a research advisor and choose two other faculty for your MS committee.
4. No later than the first Monday in March (for summer graduates), the first Monday in April (for fall graduates), or the first Monday in October (for spring graduates), you must complete a *Master's Topic and Committee Membership* form, including the *Program of Studies*, from Graduate College.
5. Complete research project and write thesis.
6. Obtain approval of thesis by your committee.
7. Two weeks before your thesis defense, turn in your thesis to the committee and complete the *Request for Authority for the Thesis Defense* form. The Committee will then be issued the *Authority Report Form for the Thesis Defense* by the

Graduate College. You may not hold your defense until the Authority form is issued. Your thesis defense must take place no later than the Friday of the last week of classes each semester and all requirements for the degree (i.e., incompletes, etc.) must be completed by the last day of classes.

8. Pass thesis defense.

II. MS in Physics with Emphasis in Astronomy

This program is identical to the thesis Masters above. There is no “non-thesis option” for this degree. However, Astronomy students can obtain a nonthesis MS in physics without the astronomy emphasis by following the rules for the nonthesis degree given above.

III. Engineering Physics

Both the thesis and non-thesis options are identical to that of the Masters degree in Physics, except that the course requirements differ in the E-Physics program.

APPENDIX B

Quick guide to steps in PhD programs in Physics, Astronomy, and Engineering Physics

I. Physics and Astronomy:

- A. Complete 90 credit hours of graduate course work. Your GPA must be above 3.00 and no more than 2 grades of C or below, ever.
 1. Of those 90 credit hours, 36 hours must be graduate coursework in Physics and Astronomy at the 4000 level and above.
 2. Of those 36, 21 must be in the specified core courses.
 3. Courses may be taken from other departments if they are listed with a G before the course number
 4. No more than 12 credit hours can be below the 5000 level.
 5. Your committee may ultimately allow substitutions of equivalent courses. Up to 44 hours of previous graduate work can be transferred at the request of your Advisory Committee.
- B. Complete 54 additional course and research hours.
- C. Pass the Physics PhD Qualifying Exams.
- D. Select research advisor & four other members for an Advisory Committee.
- E. Have an advisory conference at which the *Report of the Advisory Conference* is completed; submit the report to the Graduate College. This Advisory Conference and the associated program of study should be completed during your second year. It is not necessary to have passed all parts of the Qualifier to assemble your committee and have this advisory meeting.
- F. Pass the PhD General Examination for admission to candidacy.
- G. Complete research for PhD dissertation and write dissertation, with approval by advisor.
- H. Review *Information for Candidate for the Doctoral Degree* packet from Graduate College.
- I. Submit reading copies of dissertation to Graduate College and Doctoral Committee members at least one month before defense.

- J. Apply two weeks in advance at Graduate College for permission to take final oral examination so that the *Request for Authority (Final Examination form)* can be issued to your doctoral committee chair.
- K. Pass the final oral defense of the dissertation.

II. Engineering Physics

Basically the same as Physics & Astronomy except for course requirements .

APPENDIX C

"OPTIMAL PATH" FOR COURSES FOR THE PHD

For the student's information, we present the following "optimal path." This is intended as a guide to completing the 36 hours of course requirements for the PhD in the first four semesters. This path presents the optimal sequence of coursework in order to be fully prepared to pass the written Qualifying Exam as early in the student's career as possible. While some students may lack the preparation to actually follow this path, we hope that students will use it as a guide to the faculty's expectations.

PhD (Physics)

Sample Path, Physics	
August Qualifiers	Free attempts on any exam.
Fall semester of first year	PHYS 5000: Introduction to Graduate Studies PHYS 5013: Math Methods PHYS 5153 Classical Mechanics PHYS 5393 Quantum Mechanics I
January Qualifiers	Free attempt on any exam not yet taken.
Spring Semester	PHYS 5163 Statistical Mechanics PHYS 5403 Quantum Mechanics II PHYS 5573 Electrodynamics I
August Qualifiers	Required to take any two exams
Fall Semester of second year	PHYS 5583 Electrodynamics II Graduate elective Graduate elective
January Qualifiers	Required to take any two exams
Spring semester	Graduate elective Graduate elective Graduate elective
August Qualifiers	Must have attempted all exams once
After completing qualifying exams	To get a Master's degree based on the Qualifying Exam results you must petition the graduate college with a Program of Study form one semester before taking a non-thesis examination with your advisory committee confirming your mastery of Qualifying Exam physics. Alternatively, the General exam may serve as the master's non-thesis exam.
Fall & Spring semesters of third year	Student must complete General Exam for candidacy by the end of the first semester of their fourth year.

Physics (Astronomy) Ph.D.

Sample Path, Astrophysics	
August Qualifiers	Free attempts on any exam.
Fall semester of first year	PHYS 5001: Introduction to Graduate Studies PHYS 5013: Math Methods PHYS 5153 Classical Mechanics ASTR 4303 Stellar Astrophysics or other ASTR course
January Qualifiers	Free attempt on any exam not yet taken.
Spring Semester of first year	PHYS 5163 Statistical Mechanics PHYS 5573 Electrodynamics I ASTR graduate elective
August Qualifiers	Required to take CSM and EM exams
Fall Semester of second year	PHYS 5583 Electrodynamics II PHYS 5393 Quantum Mechanics I ASTR Graduate elective
January Qualifiers	Required to take any two exams
Spring semester of second year	PHYS 5403 Quantum Mechanics II ASTR Graduate elective ASTR Graduate elective
August Qualifier	Must have attempted all exams once (including Astrophysics Exam).
Fall & Spring semesters of third year	Students must complete General Exam for candidacy by the end of the first semester of their fourth year.

APPENDIX D

SCHEDULE OF ADVANCED TOPICS COURSES IN PHYSICS

Fall	Spring
PHYS 5213 Nuclear and Particle	PHYS 5243 Solid State Physics
	PHYS 5813 Atomic and Molecular Physics
	PHYS 6433 Quantum Field Theory

Courses offered intermittently based on student demand	
PHYS 5223 Optics	PHYS 6213 Advanced Particle Physics
PHYS 6243 Advanced Solid State Physics	PHYS 6283 Advanced Atomic and Molecular Physics
PHYS 6333 General Relativity	PHYS 6810 Collision Dynamics
PHYS 6443 Advanced Quantum Field Theory	PHYS 6860 Advanced Math Methods

The schedule shifts due to faculty commitment and student interest.

As interest and resources permit, the Graduate Studies Committee will consider additions to this list of advanced courses, such as seminar courses in specialized topics. Students in condensed matter physics may wish to choose advanced courses in Electrical Engineering (e.g ECE 5303 Solid State Devices, or CH E 5183 Graduate Transport Phenomena).

One-hour seminars in each of the research areas are offered every semester.

APPENDIX E

English Proficiency Exams

To have any teaching contact with students, it is a university requirement that international students be certified by the English Assessment Program in the Graduate College. There are four levels of certification: NC (no contact), C, B, and A. Level C students can only serve as graders. Level B can teach labs and discussion section under the supervision of a faculty member. Level A can be full TAs, and can teach free-standing courses, for example, in the summer. For information on how to get certified in English proficiency, contact the EAP office, which gives examinations and English courses throughout the year. It is the policy of the department to encourage students to seek the highest level of English certification possible. Not only will that allow students to serve as independent teachers, but such proficiency will be extremely useful throughout your career in physics.