

Requirements for Master's Degrees in Physics

Students obtaining a master's Degree in Physics must satisfy both general University requirements and departmental requirements.

The Physics Department awards either a "General Master's Degree" or an "Applied Master's Degree" depending on course of study. (See the Director of Graduate Studies for the department requirements for the Applied Master's Degree).

In addition to satisfying the [general University requirements](#) (see link) and the general Department requirements (detailed below), candidates complete the physics department requirements by one of the following methods, each of which is described further below:

1. Submitting a written thesis in accordance with Graduate School requirements
2. Taking specific physics graduate courses. Waivers of departmental requirements may be obtained by applying to the Director of Graduate Studies.

Those candidates who can demonstrate competence in a foreign language equivalent to that attained at the end of two years of college study of a foreign language may receive a M.A. degree, if they wish. All others receive a M.S. degree.

General Department Requirements:

- Prior training equivalent to a bachelor's degree in physics.
- **A total of 45 graduate credits of which at least 30 credits are earned University of Oregon courses. The grade point average for all graduate work at the University must be 3.0 or better.**
- At least 32 credits must be in physics, including at least one full-year sequence at the 600 'core' course level (listed under Specific Course Requirements Option below). The 32 credits in physics must be graded.
- **The remaining credits may be earned in related fields**, such as mathematics, chemistry, biology, geology or other courses approved by the Director of Graduate Studies.
- At least 3 term-length courses in mathematics are required. This requirement usually is met totally or in part by previous courses taken in a mathematics department. However, courses selected from the following list will satisfy the requirement provided that they include a two or three term sequence. Other courses may also be acceptable, but they must be approved by the Director of Graduate Studies prior to registration.
 - MATH 511, 512: Functions of a Complex Variable I, II
 - MATH 513, 514, 515: Introduction to Analysis I, II, III
 - MATH 521: Differential Equations II
 - MATH 522, 523: Fourier Series and Orthogonal Functions; Fourier and Laplace Integrals
 - MATH 531, 532, 533: Introduction to Topology; Differential Geometry
 - MATH 541: Linear Algebra
 - MATH 544, 545, 546: Introduction to Abstract Algebra I, II, III

- MATH 551, 552, 553: Introduction to Numerical Analysis I, II, III
- MATH 561, 562, 563: Introduction to Mathematical Methods of Statistics I, II; Mathematical Methods of Regression Analysis and Analysis of Variance

Options for completion of the General Master's Degree:

The general department requirements described above are required of all General Master's candidates. In addition, a student can either submit and defend a written thesis, or successfully complete specific courses. These two options are described below.

Master's Thesis Option:

Students who choose to submit a Master's Thesis must complete the following:

1. Secure a thesis advisor.
2. Inform the Director of Graduate Studies, who will appoint an advisory committee consisting of three physics faculty members including the advisor as chairman.
3. The candidate will meet with the committee, which will judge the proposed scope and content of the thesis. Both of these should be reasonably well-defined at the outset. The thesis should be worthy of at least 9 graduate credits and should require some original contribution by the student. Submission of the thesis to the committee members (step 5) may occur no earlier than three months after this committee meeting.
4. Complete 9 credits of Thesis (PHYS 503) or 6 credits of Thesis and 3 credits of Research (PHYS 601).
5. Submit the Master's Thesis to the committee members. If the committee agrees that the thesis does not require major revisions in its scope or content, it will schedule an oral defense.
6. Present a short oral defense of the thesis to the committee.
7. Submit the thesis in a form acceptable to the Graduate School.
8. Students must complete the Master's thesis within three years of the date of admission to the graduate program.

Specific Physics Courses Option:

Students may also choose the specific physics course option. The courses that are used to satisfy the general requirement may also be used to satisfy this requirement.

- Students must take at least 40 credits in graduate physics courses at the University of Oregon. The 40 credits in physics must be graded and a GPA of at least 3.0 must be achieved

- Six courses must be chosen from the three groups below. **Each of these courses must be completed for a B- grade or better (this may entail retaking courses).**
 - **Group 1** : PHYS 631, 632, 633 Quantum Mechanics
 - **Group 2** : PHYS 611, 612/613, 614 Theoretical Mechanics/Statistical Physics [612 (2 Credits) & 613 (2 Credits) count for one 4-credit course]
 - **Group 3** : PHYS 610 Mathematical Methods, PHYS 622, 623 Electromagnetic Theory
- Students must take twelve credit hours of laboratory or related courses. Courses taken from the following list will satisfy the requirement:
 - PHYS 510 (Scientific Computation)
 - PHYS 510 (Modern Optics Lab)
 - PHYS 581 (Design of Experiments)
 - {we should offer?} PHYS 591, 592, 593 (Advanced Projects lab)
 - Any physics special topics class that is primarily lab or data oriented

Other laboratory courses may be approved by the Director of Graduate Studies. The approval for these laboratory courses other than those listed above must be made prior to the time of registration. These laboratory courses also must be taken as graded courses.

If the student chooses the Specific Physics Courses Option then all courses for the Master's degree must be completed within a three year period starting from the time the student enters the physics graduate program.

Requirements for the Ph.D. Degree in Physics

To obtain a Ph.D. in Physics, a student must meet both [University doctoral requirements](#) and Departmental requirements. The Physics Department may accept for the fulfillment of any departmental requirement work at another institution, results of a special examination, or any other appropriate evidence which substantially meets the spirit of the requirement. The most important requirements are listed below:

Residency and GPA

The student must complete three years full-time work beyond the bachelor's degree with at least one academic year (three consecutive terms of full-time study, with a minimum of 9 completed graduate credits per term) in residence on the Eugene campus after the student is officially enrolled in Ph.D. program. The grade point average for all graduate work at the University must be 3.0 or better.

Coursework

Core Coursework

The student must complete the department's core graduate courses: PHYS 611,612 Mechanics, PHYS 613,614 Statistical Physics, PHYS 622, 623 Electromagnetic Theory, PHYS 631, 632, 633 Quantum Mechanics and PHYS 610 Mathematical Methods. Students who can demonstrate adequate competence in one or more of these subjects based on previous study in graduate-level courses can be excused by the Director of Graduate Studies from completing the corresponding required courses here.

Minimum Core Course Grade Requirements

Students must complete each core course with a minimum grade of B-. If a student obtains a grade of C+ or lower on a core course, it must be re-taken and a grade of B- or better obtained to satisfy the Core Course Grade Requirement. Note that Graduate School requires graduate students to maintain a GPA average of 3.0 (B grade) or higher to continue in the program. Grades in graduate physics courses taken elsewhere, and deemed equivalent to UO courses by the Director of Graduate Studies (see previous section), must have a recorded grade of B- or better in order to count towards Minimum Core Course Grade Requirements.

Specialized Coursework

The student must take at least six additional 4-credit graduate courses beyond the [physics core courses](#). Normally these courses will be additional courses in physics, but they may include other graduate science or mathematics courses as approved by the Director of Graduate Studies.

Reading Courses

Whenever a student takes a reading course it will be listed as “PHYS 605”. However, the subject of that course does not appear on transcripts or elsewhere (and many different subjects are taken under the umbrella of PHYS 605). Therefore, before such a course is taken, it is the obligation of every student taking that course to obtain approval from the Director of Graduate Studies. At most two 4-credit reading courses may count towards the six additional courses required (described in the previous section).

Advisor and Advisory Committee Structure

First Year:

Fall Term: In the Fall term and continuing into the first part of the Winter term, each first-year student should initiate conversations with faculty and senior students in research groups to explore possible research fields of interest. By the middle of the Fall term students should attend (sit in on) group meetings of research groups of interest, attend seminars given by UO and external faculty, postdocs, and senior graduate students, and read recent publications by UO researchers.

By the end of week 7 of the Fall term, first year graduate students shall submit a brief report on these activities, via email, to the Director of Graduate Studies, with a cc to the Education Programs Manager. Note that this is distinct from the Winter Term “Checkpoint Document” described below.

Winter Term: “Checkpoint Document”

The Checkpoint Document details progress towards building a foundation for the student’s Ph.D. research, in particular finding a research area and a research advisor. .

By the end of Week 4 of Winter Term each student must submit a short (approximately half a page) report which describes one-on-one meetings with at least three faculty as well as at least one of the following: conversations with more senior graduate students about research experiences in particular groups, “sitting in” on research group meetings, attending seminars given by UO and external researchers, and reading recent publications by UO research groups.

The student should state their tentative plans for the coming summer. The department is looking for evidence of serious effort, but the report need not be long, nor definitive. Students who have already found a research advisor should nonetheless submit a checkpoint document. The advisor should be indicated, as well as meetings with additional faculty, seminars attended, etc. Meetings with faculty will likely help form the basis of the student's advisory committee (see below).

The First-Year Advising Committee (FYAC)

The FYAC consists of three faculty members from the Graduate Studies Committee, plus the Director of Graduate Studies. The committee reads the Checkpoint Document and briefly meets with each first-year student during weeks 5-6 of Winter Term to assess progress towards finding a research home. The committee may also provide feedback to the student before this meeting. After the required meeting the committee can recommend that departmental financial support not be granted if it finds that inadequate efforts have been made toward establishing future plans.

Second Year:

In the second year, all students will meet with one of the following graduate faculty advisory committees:

- Ph.D. Advising Committee (PhDAC), if the student has formed their PhDAC before the end of Fall Term in their second year.
- Comprehensive Exam Committee, if the student schedules the Comprehensive Examination before the end of Spring quarter in their second year.
- FYAC, if the student has not yet formed their PhDAC.

Ph.D. Advising Committee (PhDAC)

During the student's second year, but no later than the end of Fall Term of their third year, the student is expected to form a PhDAC. **It is the student's responsibility to secure the membership of the PhDAC and inform the Director of Graduate Studies who will approve the committee.** The PhDAC will verify that the student has an advisor, is making adequate progress towards research productivity, and has met the Minimum Core Course Grade Requirements.

The PhDAC committee consists of:

1. Advisor (or a member of the Graduate Faculty, if the student does not yet have an advisor), normally a faculty member of the Department of Physics.

2. Chair of the committee who must not be the advisor, but must be a faculty member in Department of Physics.
3. One additional faculty member in the Department of Physics.

The committee should normally consist of at least one theorist and at least one experimentalist / observer. The Director of Graduate Studies will approve the committee. The Chair has the responsibility to call and chair meetings of the committee and report the results of these meetings to the Director of Graduate Studies.

The FYAC will meet with those students who have not yet formed their PhDAC by the end of winter term of their second year. The committee will usually request a short written progress report by the student. The report shall be delivered to the committee at least one week prior to the committee meeting. (In the event that the student is doing research away from campus, the committee may, at its discretion, modify these procedures appropriately). As in the first year, the FYAC can recommend that a student not be granted departmental financial support if it finds that inadequate efforts have been made toward establishing future plans.

In the event the student does not yet have an advisor, the FYAC will assess the student's interests and aptitudes to help the student find a suitable research home. **It is ultimately the student's responsibility to find a research advisor willing to advise them.** A student who is unable or unwilling to find an advisor will not be permitted to continue in their graduate studies in physics.

Third Year:

The Comprehensive Examination should be taken by the end of spring term of the third year. If this is not possible, the student must meet with their PhDAC by the end of spring term of the third year. In the event that the student is doing research away from campus, the committee may, at its discretion, modify these procedures appropriately. Future funding of the student from departmental sources will be contingent upon the student meeting with either the PhDAC or taking the Comprehensive Examination during their third year.

Comprehensive Examination

Overview

The objective of the Comprehensive Examination is to assess a student's capacity for independent research in their chosen area of specialization. A successful outcome is necessary

for the advancement to candidacy for the PhD degree. The examination evaluates the student's readiness to begin research work in their chosen specialty. The Comprehensive Examination is generally administered after the student has completed a majority of the coursework requirements for a PhD and has begun substantial research activities with a faculty advisor. A student will have typically completed at least 3 quarters of research credits (PHYS 601) with the same advisor prior to scheduling their comprehensive exam. The comprehensive examination, which is administered by the Comprehensive Exam Committee, consists of two components – a written proposal and an oral examination.

To expedite advancement to candidacy, however, the Department does not require full completion of the Specialized Coursework requirements at the time of the Comprehensive Exam. **The requirement for the Comprehensive Exam is that the student has passed 3 or more of their Specialized Courses (with a grade of B or higher) at the time of the exam.**

Students are generally expected to schedule their Comprehensive Exam in their second or third year of graduate studies. **The deadline for taking the Comprehensive Examination is the end of fall term of the fourth year.** Only under exceptional circumstances will the Director of Graduate Studies consider delaying this requirement by up to two quarters. **Any student who has not passed the Comprehensive Examination by the end of spring quarter of their fourth year will not be allowed to continue in the graduate program.** This deadline can only be extended with approved leave from the graduate school.

A brief summary of procedures for the Comprehensive Exam follows below.

Forming a Comprehensive Exam Committee

Once a student has begun working with a research advisor and they agree to collaborate on a thesis project, the student should consult with their research advisor to identify appropriate committee members for the Comprehensive Exam. Typically this should occur in the student's second year of graduate studies. The Comprehensive Exam committee members normally continue to advise the student throughout their PhD until the defense as the Dissertation Committee.

The comprehensive examination committee must consist of at least four members, at least three of whom must be members of the Graduate Faculty. Normally the committee will be formed by adding one additional member to the PhDAC:

1. Advisor, who is a member of the Graduate Faculty, normally a faculty member of the Department of Physics.
2. Chair of the committee who must not be the advisor, but must be a faculty member in Department of Physics.
3. One additional faculty member in the Department of Physics.

4. Institutional Representative -- one faculty member from a department other than the Department of Physics.

A typical composition of physics faculty for the comprehensive examination would comprise the thesis advisor, a theorist, and an experimentalist / observer in the general area of the student's specialty. The Chair has the responsibility to call and chair meetings of the committee and report the results of these meetings to the Director of Graduate Studies.

If the advisor is not a member in the Department of Physics, then one additional member from the Department of Physics is added to the Comprehensive Exam Committee, totaling five members.

It is the **candidate's responsibility** to contact each member of their comprehensive committee and **to schedule a date and two-hour time slot** for the exam that all the committee members can attend. At least one week prior to the date of the Comprehensive Examination the student will communicate by email to both the Director of Graduate Studies and Education Programs Manager in the Department of Physics the date and time of the examination and the list of members of the committee.

Under special circumstances the Director of Graduate Studies may authorize the examination to proceed with as few as three committee members present. However, these committee members must include the committee chair and the advisor. (Note that, although in exceptional circumstances the Director of Graduate Studies may authorize the Comprehensive Examination to take place without the committee member from outside the Department of Physics, the rules of the Graduate School require that the outside member be present at the thesis defense).

Note the Graduate School policy on the Dissertation Committee policy in regards to advisors who are outside the student's home department:

<http://gradschool.uoregon.edu/committee-policy>. "If the Advisor is not a member of the degree-granting department, the Institutional Representative ("outside member") must be from a different department or Research Institute than the Advisor."

Part 1: Written Comprehensive Proposal

The comprehensive proposal is the student's written proposal for thesis research, including a project timeline with clear proposed research objectives. It should take the form of **a paper of no more than 10 pages, including figures and bibliography**. The paper should explain the broader context and rationale for the project, the problem to be studied, the methods to be employed, and the expected results. The paper should be written so that members of the Comprehensive Exam committee who are not experts in the student's subfield can understand the motivation for, the methods used in, and the results obtained in the project. Committee

members must receive a **final copy of the paper at least one week before the exam**. At this time, the student must also provide the Director of Graduate Studies and Education Programs Manager in the Department of Physics with a final electronic PDF copy of the paper.

Part 2: Oral Comprehensive Examination

The oral comprehensive examination consists of an oral presentation by the student on the motivations for the proposed project, the methods planned in that project, any preliminary results obtained, and the proposal for future research. This will generally follow the Comprehensive Proposal document provided to the comprehensive examination committee prior to the examination. Students should keep two things in mind when preparing their presentation: First, **the presentation should be no more than 30 minutes in length when given without questions**. Committee member questions during the comprehensive exam typically lengthen the presentation considerably, and the ensuing discussions usually comprise the main body of the 1.5 – 2 hours. Second, the presentation should be at a level where members of the comprehensive committee who are not experts in your subfield can understand the motivations for, methods used in, and results obtained in your project.

While the comprehensive paper forms the basis for the oral Comprehensive Examination, the committee will not necessarily focus exclusively on this topic during the oral comprehensive examination. More general questions on the basic physics fundamental to the proposed thesis should also be expected to determine the preparedness of the student for advancement to candidacy. The examination will also test familiarity with basic literature in the chosen field of research.

It is the student's responsibility to ensure that any needed audio/visual equipment is reserved and working properly in advance of the comprehensive examination.

Comprehensive Exam Evaluation

To determine the outcome of the comprehensive examination, the student will be evaluated on their understanding of the problem, ingenuity, and ability to apply their knowledge in the proposed research area. The committee will take into account both written and oral components of the examination in making their decision. There are five outcomes assigned to the Comprehensive Examination:

1. Pass with distinction -- the student has written a clear and concise proposal, given an excellent oral presentation, and satisfactorily answered virtually all of questions posed to the student by the Comprehensive Examination Committee.
2. Pass -- the student has written a decent proposal, given an acceptable oral presentation, and satisfactorily answered most of the questions posed to the student by the Comprehensive Examination Committee.
3. Conditional Pass -- the student has minor deficiencies in their written proposal, in their oral presentation, and/or the Comprehensive Examination Committee has identified gaps in the student's understanding sufficient to warrant further examination by the committee. In this case the student has passed the exam subject to the conditions determined by the committee that may require additional work, a revised written proposal, or other written material sent to committee. The Comprehensive Examination Committee will evaluate the additional material, and if satisfied, the Conditional Pass will be replaced with Pass. This may require some back-and-forth communication between the committee and student. The committee must be satisfied to remove the conditions within 6 months, otherwise the Conditional Pass becomes a Fail.
4. Re-take Examination -- the student has major deficiencies in their written proposal, and/or in their oral presentation, and/or the Comprehensive Examination Committee has identified substantial gaps in the student's understanding sufficient to warrant re-examination by the committee. In this case the student has not passed the Comprehensive Exam, but may re-take it **once more** no later than 6 months following the first attempt. The committee will provide the student with guidance on the deficiencies and recommendations on how to rectify them prior to re-taking of the Comprehensive Exam. The outcome of a Re-take Examination is either Pass or Fail.
5. Fail -- the student has serious deficiencies in their written proposal, and/or their oral presentation, and/or the Comprehensive Examination Committee has serious doubts as to the student's preparedness for candidacy. This outcome would typically arise by failing to remove the conditions from a Conditional Pass, or failing to successfully Pass a Re-take Examination, 6 months after the first attempt.

A student who fails the Comprehensive Examination will not be allowed to continue in the PhD program.

The Chair of a student's committee is responsible for assigning the outcome of the Comprehensive Examination based on the committee member's recommendations and their own assessment. It is expected that the committee's recommendation will be unanimous in all but exceptional circumstances. (In the unlikely event of a disagreement among one or more committee members concerning the student's outcome, the Chair will make the final determination of the student's outcome, communicating a written summary of the disagreement and justification for the non-unanimous outcome to the Director of Graduate Studies.) The Chair communicates the outcome by email to both the Director of Graduate Studies and the Education Programs Manager.

Once the student has received an outcome of “Pass” or “Pass with Distinction” from the Comprehensive Exam Committee, the student is advanced to candidacy by the Graduate School, which then appoints the candidate’s Dissertation Committee. This committee will normally be the Comprehensive Exam Committee.

A Talk

The Department of Physics believes that every student should be capable of giving a lucid talk about physics. Accordingly, sometime during their research work (and certainly before submitting a Ph.D. dissertation) the student must give at least one talk either in a local research seminar or at a conference. If this is a local (i.e. on Campus) presentation then it must be advertised or posted in advance and the audience must include faculty. The talk may cover an item of interest in the research literature or the student’s own work. The student should send an email to the Director of Graduate Studies and the Education Programs Manager giving evidence of having given this talk. This could include a meeting abstract with authorship; or a meeting name and date; or an advertisement for a talk given on Campus is sufficient. This evidence must be received prior to when the student schedules their final examination/thesis defense.

Dissertation

The student must write a dissertation. It must embody the results of research and show evidence of originality and ability to perform independent investigation. The student must take at least 18 credits of Dissertation (PHYS 603) after advancement to candidacy in order to graduate. Additionally, students are required to be enrolled in a minimum of 3 Dissertation credits the term the student applies to graduate.

Annual Progress Meeting

The student must schedule a meeting with the Chair and the Advisor of their Dissertation Committee once per year following passing the Comprehensive Examination. The purpose of the meeting is to assess the student’s progress towards completion of their dissertation. The student will be expected to write a brief progress report and a timeline for completion of their dissertation. The Chair of the committee will inform the Director of Graduate Studies and the Education Programs Manager of the assessment of the student’s progress and timeline.

Final Examination – “Thesis Defense”

The student must pass the Final Examination, which is the defense of the dissertation. For important regulations concerning the time of notices, final approval of the thesis, etc., consult the UO online catalog and the Graduate School.

It is the **candidate's responsibility** to contact each member of their dissertation committee and **to schedule a date and two-hour time slot** for the exam that all the committee members can attend.

As soon as the dissertation defense date is set, the student must send a copy of the dissertation title and abstract to the Education Programs Manager, so this can be put in an email announcement sent to the Department of Physics. The student must also prepare an announcement flyer and post it on bulletin boards throughout Willamette Hall. (The dissertation defense is required to be open to the public and must be announced.)

Time Limits for Ph.D. Degree

The candidate cannot graduate any sooner than six months after the appointment of the Dissertation committee. The Graduate School sets a seven (7) year time limit on completing Ph.D. degrees. The Department of Physics will not provide departmental support to any student past the seven year time limit. Under special circumstances this can be extended via a petition process (c.f., <https://gradschool.uoregon.edu/node/217>), but acceptance of petitions is by no means guaranteed.