

# Physics, PhD

## Doctoral Candidacy

To earn a PhD at Washington University, a student must complete all courses required by their department; maintain satisfactory academic progress; pass certain examinations; fulfill residence and Mentored Experience Requirements; write, defend, and submit a dissertation; and file an Intent to Graduate. For a general layout of doctoral degree general requirements in Arts & Sciences, including an explanation of Satisfactory Academic Progress, students should review the Doctoral Degree Academic Information page of the Arts & Sciences *Bulletin*.

## Program Requirements

- **Total Units Required: 36 (Note:** Remission applies for a maximum of 72 graduate-level units.)
- **Degree Length: 5 Years**
- **Funding:** Students who are admitted to the PhD program in Physics receive a complete financial support package including full tuition and a stipend/salary for the academic year. Financial support is guaranteed by the department for the first five years for students who are making satisfactory progress towards their PhD.

## Year One

- Fall: Take 3 or 4 courses, plus Physics 582 and Physics 597.
- Spring: Take 3 or 4 courses. Assistant in Instruction for one course. Look for a thesis advisor.

## Year Two

- Fall: Take 3 or 4 courses. Assistant in Instruction for one course. Confirm your thesis advisor and qualifying committee by submitting the Research Advisory Committee (RAC) form.
- Spring: Take 3 or 4 courses. Complete the qualification procedure (below).

## Year Three

- Thesis research. Students no longer enrolling in 9 units of academic courses must enroll in LGS9000.

## Year Four

- Thesis research. Students no longer enrolling in 9 units of academic courses must enroll in LGS9000.
- Submit Title, Scope and Procedure Form.

## Year Five

- Complete research. Students no longer enrolling in 9 units of academic courses must enroll in LGS9000.
- Submit dissertation defense committee form to the graduate program administrator.
- Write dissertation, undergo oral defense and submit dissertation to the Office of Graduate Study.

## PhD in Physics

### Outline of Requirements

- Complete 36 units of academic credit (detailed below), maintaining an average grade of at least a B (3.0 GPA).
- Pass the PhD qualification procedure. This requirement must be completed before a student can formally join a research group and is normally completed before the start of the third year.
- Complete the teaching requirements.
- Write a thesis (doctoral dissertation information below).
- Pass an oral dissertation defense examination.

## 36-Unit Academic Credit Course Requirement

Courses that count toward academic credit are as follows:

- Any regular 500-level lecture courses in the physics department, including Physics 597 Supervised Teaching of Physics and Physics 582 Research Seminar
- Courses outside of the physics department, if approved by the student's advisor and the director of graduate studies
- Special topics courses, for which students should register: Physics 589 Selected Topics in Physics I/Physics 590 Selected Topics in Physics II
- Supervised research, for which students should register: Physics 593 Introduction to Methods in Physics/Physics 594 Introduction to Methods in Physics (Supervised research may be used for a maximum of 6 units of academic credit.)
- **Note:** Students must be enrolled in 9 graduate credits each semester to retain full-time status. As students complete their course work, if enrolled in fewer than 9 graduate credits, they must enroll in a specific Arts & Sciences graduate course that will show 0 units but does count as full-time status. Students should connect with their department to ensure proper enrollment prior to Add/Drop.

## PhD Qualification: Course Requirements

For qualification, students must pass six core 500-level physics courses. In those courses, the student must maintain an average of a B (3.0 GPA), with no more than one grade lower than B-. A given core course may be taken only once. If more than six core courses are taken, the GPA will be determined from the best six course grades.

**Students must take the following four courses:**

Code	Title	Units
Physics 501	Theoretical Physics	3
Physics 505	Classical Electrodynamics I	3
Physics 523	Quantum Mechanics I	3
Physics 529	Statistical Mechanics	3
<b>Total Units</b>		<b>12</b>

**They must also take at least two of the following:**

Code	Title	Units
Physics 502	Methods of Theoretical Physics II	3
Physics 506	Classical Electrodynamics II	3
Physics 507	Classical Mechanics	3
or Physics 509	Nonlinear Dynamics	
Physics 524	Quantum Mechanics II	3

These requirements can be modified for students who have completed equivalent courses while working toward a master's degree in physics at other universities.

## PhD Qualification: Oral Examination Requirement

To qualify, the student must give a presentation to a committee of three physics faculty members (i.e., the prospective research advisor and two others). The student should demonstrate a basic understanding of a major topic of current research in the selected area of study, chosen in consultation with the student's prospective thesis advisor. One week before the oral exam, the student must prepare a written paper (approximately 1500-3000 words) summarizing the content of the presentation and give it to the committee. The student's responses to questions raised by the examination committee are graded as adequate or not. Students have a chance to respond to inadequately answered questions in writing within 48 hours after the examination. The student is not allowed to receive assistance in preparing the written response from any other individuals. The answers should either be given in person to the chair of the examination committee or emailed to the chair as a PDF file so that it is time stamped. The committee will determine whether the written answers are sufficient.

The committee must be chosen and approved by the department chair by the end of a student's third semester (typically in December of the second year). The oral examination should be taken by the end of a student's fourth semester (typically in May of the second year). If the student fails the oral examination, they can take it again one additional time.

## Teaching Requirements

These requirements must be completed before the student submits their doctoral dissertation to the Office of Graduate Studies, Arts & Sciences:

- **Complete L31 Physics 597:** Graduate students are required to take Physics 597 Supervised Teaching of Physics prior to serving as an assistant in instruction. Students typically take this course during their first fall semester.
- **Complete at least two semesters of mentored teaching experiences**
- **Complete four hours of oral presentations:** Graduate students must complete a total of four hours of specialized oral presentations. Examples of such presentations include teaching a class (e.g., when substituting for a professor); giving seminars, such as the weekly graduate seminar; or giving oral presentations at conferences, journal clubs, and the like.

## Qualifying Examinations

Progress toward the PhD is contingent upon the student passing examinations that are variously called *preliminary*, *qualifying*, *general*, *comprehensive*, or *major field exams*. The qualifying process varies according to the program. In some programs, it consists of a series of incremental, sequential, and cumulative exams over a considerable time. In others, the exams are held during a relatively short period of time. Exams may be replaced by one or more papers. The program, which determines the structure and schedule of the required examinations, is responsible for notifying the Office of Graduate Studies, Arts & Sciences, of the student's outcome, whether successful or unsuccessful.

## Mentored Experience Requirements

Doctoral students at Washington University must complete a department-defined Mentored Experience. The Mentored Experience Requirement is a doctoral degree milestone that is notated on the student's transcript when complete. Each department has an established Mentored Experience Implementation Plan in which the number of units that a student must earn through Mentored Teaching Experience(s) and/or Mentored Professional Experience(s) is defined. The Mentored Experience Implementation Plans outline how doctoral students within the discipline will be mentored to achieve competencies in teaching at basic and advanced levels. Some departments may elect to include Mentored Professional Experiences as an avenue for completing some units of the Mentored Experience

Requirement. Doctoral students will enroll in LGS 6XXX Mentored Teaching Experience or LGS 7020 Mentored Professional Experience to signify their progression toward completing the overall Mentored Experience Requirement for the degree.

## The Doctoral Dissertation

A Research Advisory Committee (RAC) must be created no later than the end of the student's third year; departments may set shorter timelines (e.g., by the end of the student's second year) for this requirement. As evidence of the mastery of a specific field of knowledge and of the capacity for original scholarly work, each candidate must complete a dissertation that is approved by their RAC.

A Title, Scope & Procedure Form for the dissertation must be signed by the committee members and by the program chair. It must be submitted to the Office of Graduate Studies, Arts & Sciences, at least 6 months before the degree is expected to be conferred or before beginning the fifth year of full-time enrollment, whichever is earlier.

A Doctoral Dissertation Guide & Template that give instructions regarding the format of the dissertation are available on the website of the Office of Graduate Studies, Arts & Sciences. Both should be read carefully at every stage of dissertation preparation.

The Office of Graduate Studies, Arts & Sciences, requires each student to make the full text of the dissertation available to the committee members for their review at least 1 week before the defense. Most degree programs require 2 or more weeks for the review period; students should check with their faculty.

## The Dissertation Defense

Approval of the written dissertation by the RAC is necessary before the student can orally defend their dissertation. The Dissertation Defense Committee that observes and examines the student's defense consists of at least five members, who normally meet these two, independent criteria:

1. Four of the five must be tenured or tenure-track Washington University faculty; one of these four may be a member of the emeritus faculty. The fifth member must have a doctoral degree and an active research program, whether at Washington University, at another university, in government, or in industry.
2. Three of the five normally come from the student's degree program; at least one of the five must not.

All committees must be approved by the Office of Graduate Studies, Arts & Sciences, regardless of whether they meet the normal criteria.

The committee is appointed by the Office of Graduate Studies, Arts & Sciences, upon the request of the degree program. The student is responsible for making the full text of the dissertation accessible to their committee members for their review in advance of the defense. Faculty and graduate students who are interested in the subject of the dissertation are normally welcome to attend all or part of the

defense but may ask questions only at the discretion of the committee members. Although there is some variation among degree programs, the defense ordinarily focuses on the dissertation itself and its relation to the student's field of expertise.

## Submission of the Dissertation

After the defense, the student must submit an electronic copy of the dissertation online to the Office of Graduate Studies, Arts & Sciences. The submission website requires students to choose among publishing and copyrighting services offered by ProQuest's ETD Administrator. The degree program is responsible for delivering the final approval form, signed by the committee members at the defense and then by the program chair or director, to the Office of Graduate Studies, Arts & Sciences. Students who defend their dissertations successfully have not yet completed their PhD requirements; they finish earning their degree only when their dissertation submission has been accepted by the Office of Graduate Studies, Arts & Sciences.

## Master's Degree Along the Way

- Complete 36 units of academic credit, maintaining an average grade of at least a B (3.0 GPA).
- Pass the PhD qualification procedure.

Website: <http://physics.wustl.edu/graduate>