

# PHYSICS (PHD)

## Doctor of Philosophy in Physics

Unit: College of Arts and Sciences (<https://louisville.edu/artsandsciences/intro/>) (GA)

Department: Physics & Astronomy (<https://louisville.edu/physics/>)

Academic Plan Code(s): PHYSPHD

## Program Information

### Mission Statement

The Doctor of Philosophy degree in Physics will prepare students for research-oriented careers in government, industry, and academia. Students in this program develop strong analytical, quantitative, and problem solving skills, including a deep appreciation for connections between physics and scientific computing, physics and engineering, or physics and mathematics, that serve to expand their career options in computer hardware/software companies, large semiconductor industries, including many non-STEM job sectors such as finance, business and health care.

### General Information

The PhD is typically a five-year degree program available to qualified individuals possessing a bachelor's degree in Physics from an accredited college or university. Students with a bachelor's degree in other related subjects—e.g. Mathematics, Chemistry and Engineering—also will be considered.

The first two years of the program are very similar to the non-thesis MS program. Under normal circumstances, PhD students will meet the requirements for the MS degree after two years of study. The remaining three years will be dedicated primarily to research leading to the required dissertation.

### Graduate Assistantships

For the first two years of the program, qualified students will be considered for Graduate Teaching Assistantships (GTAs). As part of the educational experience, GTAs perform certain undergraduate teaching responsibilities in exchange for a stipend and full tuition remission. In most cases, support for the remaining three years of study is via Graduate Research Assistantships (GRAs) provided by extramural faculty research funding.

## Admission Requirements

Departmental requirements for admission are as follows:

- A baccalaureate degree with at least 24 credit hours in Physics, or the equivalent.
- A minimum quality-point standing of 3.0 (base 4.0) in physics courses.
- Mathematics coursework through differential equations. (MATH 405 or equivalent).
- Submission of the (general) Graduate Record Examination (general) scores. The Physics subject GRE is preferred, but not required.

For general information concerning admission to graduate programs at the University of Louisville consult the application directions from the Graduate School (<http://louisville.edu/graduate/apply/>).

## Program Admission Procedure

Admission into the Physics PhD program is competitive. The application procedure is as follows:

- Submit a completed graduate application (<http://louisville.edu/graduate/futurestudents/apply-materials/application/>) to the University of Louisville, Graduate School, together with the relevant application fee.
  - a. Admitted students are most commonly accepted to begin their program of studies in the Fall semester (which starts in late August). However, programs beginning in the Spring semester (which begins in early January) can be arranged.
  - b. There is no formal application deadline, but to ensure full consideration for Fall entry applications should be received no later than February 1.
- Official transcripts from each university or college attended must be submitted to the Graduate School, Graduate Admissions.
- Take the general section of the Graduate Record Examination and arrange for the official score to be sent to the Graduate School (the Physics subject GRE is recommended, but not required).
- Arrange for at least two letters of recommendation to be sent to the Graduate School. Persons familiar with the applicant's academic work should write these letters. Please use the recommendation form or complete the relevant section in the online application (<http://louisville.edu/graduate/apply/>) so that your letter writers will receive an email request to submit their recommendation electronically.
- All applicants for whom English is a second language must also submit official TOEFL scores of 79 or higher on the internet-based test, 213 or higher on the computer-based test. English proficiency can also be met by submitting official IELTS scores of at least 6.5 overall band score from the academic module exam or official Duolingo overall score of 105. Students holding a bachelor's or advanced degree from an accredited institution in the United States may be exempt from this requirement.

In individual cases, the department may recommend conditional admission of a student who does not satisfactorily meet the above requirements. If admission is granted, that student will be subject to those conditions specified by the Department of Physics and Astronomy, the College of Arts and Sciences and the Graduate School as being necessary to remedy the conditional admission.

## Program Requirements

General requirements for the PhD degree are set forth in the Degree Requirements (<https://catalog.louisville.edu/graduate/general-policies-procedures-requirements/degree-requirements/>) section of the graduate catalog. Specific requirements for the PhD degree in physics are as follows:

### Course Requirements

Code	Title	Hours
<b>Core Courses</b>		<b>21</b>
PHYS 561	Mathematical Physics I	
PHYS 605	Theoretical Mechanics	
PHYS 611	Electromagnetic Theory I	
PHYS 621	Quantum Mechanics I	
PHYS 622	Quantum Mechanics II	
PHYS 625	Statistical Mechanics	
PHYS 650	Research Methods in Physics & Astronomy	

Electives <sup>1</sup>	9
<b>Dissertation</b>	<b>6</b>
PHYS 699	Research
<b>Minimum Total Hours</b>	<b>36</b>

<sup>1</sup> Each student is required to take nine (9) credit hours of elective courses. Courses outside the department are acceptable if approved by the student's thesis advisor and the department Graduate Program Director.

## Qualifying Examination

In order to demonstrate proficiency in knowledge of Physics and the ability to apply that knowledge, students will be required to pass a qualifying exam. The qualifying exam will have a written and oral component.

### Written Component

To satisfy the written component, the student will take a written exam composed by members of the faculty of the department. The exam will cover basic and intermediate problems in the areas of mechanics, electricity and magnetism, quantum mechanics, thermal physics, and special topics in contemporary physics. It will be administered twice yearly with advance notice, typically in September and January. Students are required to pass all areas of the exam. For full-time students, this must normally be achieved by the end of their fourth semester and in all cases by the end of their sixth semester. Special arrangements may be made for part-time students. A total of four attempts at the exam will be permitted.

Once a subject area part of the exam is passed, that part does not need to be retaken. Under certain circumstances, in order to confirm their familiarity with a particular subject, a student may be extended the opportunity to take an oral examination in that subject.

### Oral Component

To satisfy the oral component the student must pass an oral exam, in the form of a presentation to the PhD committee of his or her proposed research. The student is expected to take the exam before the end of their sixth semester as a graduate student. The test may be taken at most two times and must be passed by the end of the sixth semester.

## Candidacy

Having passed both parts of the qualifying examination the student will register for degree candidacy and continue with their dissertation research.

## Dissertation

A doctoral dissertation is required of each student.