

Physics, PhD

Graduate study in physics and astronomy is highly individualized. The department does not offer a PhD in astronomy, but students may pursue a PhD in physics with an astronomy subprogram and a dissertation in astronomy.

Each entering graduate student is assigned a faculty advisor, who assists in preparing a plan of study and in guiding the student's progress.

Learning Outcomes

Graduates will:

- understand the foundational principles that transcend many distinct areas, and learn the technical language, problem-solving skills, and training in technical listening and discussion;
- learn, practice, and discover advanced discourse in mathematical aspects that translate to physics;
- become familiar with the state-of-the-art experimental tools and equipment in the field;
- develop skills for creativity and originality in the field and promote communication of new discoveries;
- learn and practice advanced discourse in experimental and observational aspects, including data and information mining, translating experimental observations to physical principles and vice versa; and
- learn analysis of data and computational skills as well as become familiar with state-of-the-art techniques for data processing.

Requirements

The Doctor of Philosophy program in physics requires a minimum of 72 s.h. of graduate credit. At least 39 s.h. must be earned at the University of Iowa to complete the residency requirement. For students interested in doing doctoral work in astronomy, the department offers an astronomy subprogram, including a dissertation, within the PhD program in physics. All students must maintain a program grade-point average of at least 3.00.

All students must earn at least 24 s.h. in departmental courses numbered 5000 or above. They may not count credit earned in PHYS:7990 Research: Physics, PHYS:7992 Individual Critical Study, ASTR:7991 Research: Astronomy, or seminars.

All students must take comprehensive examinations; participate in advanced seminars; do original research in experimental physics, theoretical physics, or astrophysics; and prepare and defend a written dissertation based on this work.

PhD students in physics without the astronomy subprogram must complete the following courses.

Course #	Title	Hours
PHYS:4761- PHYS:4762	Mathematical Methods of Physics I-II (students who pass a written examination are exempt from this requirement)	6
PHYS:5710	Classical Mechanics	3
PHYS:5730	Statistical Mechanics I	3
PHYS:5741- PHYS:5742	Quantum Mechanics I-II	6

PHYS:5811- PHYS:5812	Classical Electrodynamics I-II	6
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These courses freely use advanced mathematics (e.g., complex variables, tensor analysis). An introduction is provided in PHYS:4761 Mathematical Methods of Physics I and PHYS:4762 Mathematical Methods of Physics II. The selection of less advanced coursework depends on the adequacy of a student's preparation for graduate work; students' choice of more advanced and specialized courses depends on the direction in which their interests develop.

PhD students in physics with the astronomy subprogram must complete a total of six courses from the following.

Course #	Title	Hours
Four of these:		
ASTR:6782	Extragalactic Astronomy	3
ASTR:6785	The Interstellar Medium	3
ASTR:6790	Stellar Astrophysics	3
ASTR:6870	Radiative Processes in Astrophysics	3
ASTR:6880	High Energy Astrophysics	3
ASTR:7775	Special Topics in Astrophysics	3
ASTR:7830	Space and Astrophysical Plasma Physics	3
Two of these:		
PHYS:7760	General Relativity	3
PHYS:7761	Cosmology	3
PHYS:5710	Classical Mechanics	3
PHYS:5730	Statistical Mechanics I	3
PHYS:5741	Quantum Mechanics I	3
PHYS:5742	Quantum Mechanics II	3
PHYS:5811	Classical Electrodynamics I	3
PHYS:5812	Classical Electrodynamics II	3

After a student has chosen a research specialty, the student must submit a formal thesis proposal and defend the proposal in an oral comprehensive exam. The appropriate thesis advisor then becomes the candidate's general advisor and the chair of the comprehensive and final examination committee. The comprehensive exam must be taken before the beginning of the fourth year of graduate study.

Admission

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations on the Graduate College website.

Career Advancement

Graduates have opportunities for employment in universities, colleges, and research laboratories in government and industry. Physics graduates have mastered skills that are readily transferable to a number of fields. They might choose to work in engineering, software development, finance, or consulting.

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.

Academic Plans

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

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Course	Title	Hours
Academic Career		
Any Semester		
72 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website. ^{a, b}		
Students must maintain a Graduate College program GPA of 3.00 or higher. ^c		
Hours		0
First Year		
Fall		
PHYS:4761	Mathematical Methods of Physics I ^d	3
PHYS:5710	Classical Mechanics	3
PHYS:5730	Statistical Mechanics I	3
Hours		9
Spring		
PHYS:4762	Mathematical Methods of Physics II ^d	3
PHYS:5741	Quantum Mechanics I	3
PHYS:5811	Classical Electrodynamics I	3
Hours		9
Second Year		
Fall		
PHYS:5742	Quantum Mechanics II	3
PHYS:5812	Classical Electrodynamics II	3
Elective course ^e		3
Hours		9
Spring		
Elective course ^e		3
Elective course ^e		3
Elective course ^e		3
Hours		9
Third Year		
Any Semester		
Comprehensive Exam		
Hours		0
Fall		
PHYS:7990	Research: Physics	9
Hours		9
Spring		
PHYS:7990	Research: Physics	9
Hours		9
Fourth Year		
Fall		
PHYS:7990	Research: Physics	9
Hours		9

Spring

PHYS:7990	Research: Physics	9
Final Exam ^f		
Hours		9
Total Hours		72

- a Students must earn at least 24 s.h. in departmental courses numbered 5000 or above, and may not include credit earned in PHYS:7990, PHYS:7992, ASTR:7991, or seminars.
- b Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.
- c Graduate College program GPA is comprised of all courses that are approved degree requirements. If a student takes more than the minimum required number of semester hours to complete the degree, but all courses taken are eligible to count toward the degree, those courses will be included in the Graduate College program GPA.
- d Students who pass a written examination are exempt from this requirement.
- e Work with faculty advisor to determine appropriate coursework and sequence.
- f Dissertation defense.