PHYSICS

http://physics.illinois.edu

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Associate Head for Graduate Programs: Lance Cooper
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(217) 333-3645
E-mail: grad@physics.illinois.edu

Major: Physics
Degrees offered: M.S. and Ph.D.

Graduate Degree Programs

The Department of Physics is actively developing a new paradigm for graduate physics education and research for the 21st century, aimed at enhancing interdisciplinary interactions and creating an integrated approach to educational and research training. Advanced degrees offered in physics are the Master of Science and the Doctor of Philosophy. Outstanding graduate research opportunities are available in many subdisciplines of physics, including:

- condensed matter physics
- high energy and nuclear physics
- astrophysics
- atomic
- molecular and optical physics
- complex systems
- quantum information
- biological physics
- physics education research

Students may select experimental, theoretical, or computational thesis projects. Multidisciplinary projects are especially encouraged, and, with the consent of other departments, students may earn master's degrees in areas such as materials science and engineering, or computer science, simultaneously with their Ph.D. degrees in physics. Opportunity also exists for specializing in:

1. computational science and engineering and
2. energy and sustainability engineering within the department's graduate programs via the Computational Science and Engineering (CSE) Option (https://www.ece.illinois.edu/academics/grad/overview/cosc.asp) and the Energy and Sustainability Engineering (EaSE) Option (http://ease.illinois.edu).

Admission

Admission to the physics graduate program requires an outstanding record of accomplishment in an undergraduate physics program and clear evidence of considerable academic promise, as judged by test scores, letters of recommendation, and strong intellectual achievements. A bachelor's degree or its equivalent from an accredited college or university in the U.S. or an approved institution of higher learning abroad, with at least 20 semester hours (30 quarter hours) of intermediate and advanced undergraduate physics course work, is required for admission. Course preparation in electricity and magnetism, optics, mechanics, atomic and nuclear physics, quantum mechanics, mathematical physics, differential equations, and analysis is essential. Any deficiency in these areas may delay degree completion by as much as a year. (Students are expected to make up deficiencies during the first graduate year.)

A minimum GPA of 3.00 (A = 4.00) for the last two years of undergraduate work is required; however, because of space limitations, applicants with GPAs below 3.50 are rarely admitted. Students with prior graduate course work must have a minimum GPA of 3.50 for those courses. All applicants must provide test scores from both the general and the physics tests of the Graduate Record Examination (GRE) (http://www.ets.org).

Graduates of curricula in the physical and biological sciences, mathematics, or computer science may be admitted with limited standing if they are judged to have the necessary aptitudes to profit from graduate work in physics. Such students are admitted to full standing after completing course work to remove deficiencies in physics preparation.

All applicants whose native language is not English must submit a minimum TOEFL (http://www.toefl.org) score of 79 (iBT), 213 (CBT), or 550 (PBT); or minimum International English Language Testing System (IELTS) (http://www.ielts.org) academic exam scores of 6.5 overall and 6.0 in all subsections. Applicants may be exempt from the TOEFL if certain criteria (http://grad.illinois.edu/admissions/instructions/04c) are met. For those taking the TOEFL or IELTS, full admission status (http://grad.illinois.edu/admissions/instructions/04c) is met for scores greater than 102 (TOEFL iBT), 253 (TOEFL CBT), 610 (TOEFL PBT), or 6.5 (IELTS). Limited status (http://grad.illinois.edu/admissions/instructions/04c) is granted for lesser scores and requires enrollment in English as a Second Language (ESL) courses (http://linguistics.illinois.edu/students/esl/guidelines) based on an ESL Placement Test (EPT) taken upon arrival to campus.

A few applicants may be admitted for the spring semester, in addition to the customary fall semester admissions. See the Physics graduate admissions Web site (http://physics.illinois.edu/grad/apply.asp) for lists of deadlines and application materials.

Faculty Research Interests

The research specialties of Physics faculty fall into the broad categories described in the graduate programs section of this document. Details of each individual's specific interests are available at the department’s faculty research Web site. (http://physics.illinois.edu/research) Included are faculty whose primary appointments are in other departments but who supervise Physics students.

Facilities and Resources

The Department of Physics offers world-class research facilities in traditional areas of physics, including condensed matter, nuclear, particle, and optical physics, as well as state-of-the-art instruments for quantum information, nanoscale science and engineering, and biological physics. For a complete description of physics facilities, please consult the department’s facilities Web site (http://physics.illinois.edu/research/shops.asp).

Financial Aid

Fellowships, research assistantships, and teaching assistantships (all of which include waivers of tuition and some fees) are available for the majority of admitted students. All applicants, regardless of U.S.
citizenship, whose native language is not English and who wish to be considered for teaching assistantships must demonstrate spoken English language proficiency (http://grad.illinois.edu/admissions/taengprof.htm) by achieving a minimum score of 24 on the speaking subsection of the TOEFL iBT or 8 on the speaking subsection of the IELTS. For students who are unable to take the iBT or IELTS, a minimum score of 4CP is required on the EPI test (http://cte.illinois.edu/testing/oral_eng/epi_overview.html), offered on campus. All new teaching assistants are required to participate in the Graduate Academy for College Teaching (http://cte.illinois.edu/programs/ta_train.html) conducted prior to the start of the semester.

- Master of Science in Physics (http://catalog.illinois.edu/graduate/graduate-majors/physics/physics-ms)
- Master of Science in Teaching of Physics (http://catalog.illinois.edu/graduate/graduate-majors/physics/physics-teaching-ms)

**Doctor of Philosophy in Physics**

Admission to Ph.D. candidacy is based on the faculty’s evaluation of a student’s potential to carry out independent research, scholastic competence as evidenced by grades and class ranks, and satisfactory performance on the qualifying examination. Although there is no formal Ph.D. core curriculum, all candidates are expected to complete courses necessary for their research, which may include advanced courses in:

- mechanics
- electromagnetism
- light
- atomic physics and quantum mechanics
- nuclear and particle physics
- condensed matter physics
- mathematical or computational methods for physics

In addition to the required course work for the Ph.D., a candidate must also:

1. pass the qualifying examination, an in-depth test of classical mechanics, electricity and magnetism, statistical physics, and quantum mechanics (in recent years, the overall success rate on the qualifying examination has averaged 98 percent);
2. pass a preliminary examination, which consists of a brief paper on the proposed thesis topic and an oral examination that tests familiarity with the background literature and understanding of the physics underlying the thesis project;
3. complete a thesis that demonstrates the capability to produce independent research on an original topic; and
4. pass a final oral examination by a faculty committee on the results of the research project. Proficiency in a language other than English is not required.

Frequently, PHYS 597, taken prior to the preliminary exam, marks the beginning of a research relationship with a faculty member which can be formally continued as PHYS 599.

**Entering with approved M.S. degree**

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>PHYS 599</td>
<td>Thesis Research (min applied toward the degree)</td>
<td>6</td>
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</table>

Select two of the following breadth courses:

<table>
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<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>PHYS 513</td>
<td>Quantum Optics &amp; Information</td>
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</table>

or PHYS **Modern Atomic Physics**

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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>PHYS 540</td>
<td>Astrophysics</td>
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<tr>
<td>PHYS 550</td>
<td>Biomolecular Physics</td>
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<tr>
<td>PHYS 560</td>
<td>Condensed Matter Physics I</td>
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<tr>
<td>PHYS 570</td>
<td>Subatomic Physics</td>
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<tr>
<td>PHYS 597</td>
<td>Individual Study (prior to the preliminary exam)</td>
<td>1-16</td>
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Elective courses – chosen in consultation with advisor (subject to Other Requirements and Conditions below) 49 max

Total Hours 64

**Other Requirements and Conditions**

Other Requirements and Conditions may overlap

Recommended elective courses:

<table>
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<tr>
<td>PHYS 504, 505, 508 &amp; 509, 580 &amp; 581</td>
<td>&amp; denotes sequence</td>
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</table>

PHYS 599 (thesis research) cannot be taken until after the preliminary exam is passed.

Ph.D. exam and dissertation requirements:

- Qualifying exam:
  1. pass the qualifying examination, an in-depth test of classical mechanics, electricity and magnetism, statistical physics, and quantum mechanics (in recent years, the overall success rate on the qualifying examination has averaged 98 percent);
  2. pass a preliminary examination, which consists of a brief paper on the proposed thesis topic and an oral examination that tests familiarity with the background literature and understanding of the physics underlying the thesis project;
  3. complete a thesis that demonstrates the capability to produce independent research on an original topic; and
  4. pass a final oral examination by a faculty committee on the results of the research project. Proficiency in a language other than English is not required.

Frequently, PHYS 597, taken prior to the preliminary exam, marks the beginning of a research relationship with a faculty member which can be formally continued as PHYS 599.

**Entering with approved B.S. degree**

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<tr>
<td>PHYS 599</td>
<td>Thesis Research (min applied toward the degree)</td>
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<td>PHYS 597</td>
<td>Individual Study (prior to the preliminary exam)</td>
<td>1-16</td>
</tr>
</tbody>
</table>

Elective courses – chosen in consultation with advisor (subject to Other Requirements and Conditions below) 81 max

Total Hours 96

**Other Requirements and Conditions**

Other Requirements and Conditions may overlap
Recommended elective courses:
PHYS 504, 505, 508 & 509, 580 & 581 (& denotes sequence)
A minimum of 12 500-level credit hours applied toward the degree.
A minimum of 16 PHYS credit hours, with 8 at the 500 level.
PHYS 599 (thesis research) cannot be taken until after the preliminary exam is passed.
An additional maximum of 8 hours of PHYS 597 (or other individual study) may be applied toward the elective course work requirement.
These students may earn a Master of Science degree during the Ph.D. program

Ph.D. exam and dissertation requirements:
Qualifying exam:
Preliminary exam
Final exam or dissertation defense
Dissertation deposit
Minimum GPA: 2.75

1 For additional details and requirements refer to the department’s Degree Requirements (http://physics.illinois.edu/grad/degree-requirements.asp) and the Graduate College Handbook (http://grad.illinois.edu/gradhandbook).

2 Qualifying Exam Information (http://physics.illinois.edu/grad/qual.asp)