Doctor of Philosophy in Physics

Why study physics and astronomy?

Our goal is to understand the physical universe. The questions addressed by our department’s research and education missions range from the applied, such as an improved understanding of the materials that can be used for solar cell energy production, to foundational questions about the nature of mass and space and how the Universe was formed and subsequently evolved, and how astrophysical phenomena affected the Earth and its evolution. We study the properties of systems ranging in size from smaller than an atom to larger than a galaxy on timescales ranging from billions of a second to the age of the universe. Our courses and laboratory/research experiences help students hone their problem solving and analytical skills and thereby become broadly trained critical thinkers. While about half of our majors move on to graduate studies in STEM, many find employment in the private sector in diverse situations ranging from financial analysts to physicians. Graduates of all our degree programs can be found in key positions regionally, nationally, and internationally. In this way, our department is at the forefront of telling the academic story of the University of Kansas to people around the state and around the world.

Admission to Graduate Studies

An applicant seeking to pursue graduate study in the College may be admitted as either a degree-seeking or non-degree seeking student. Policies and procedures of Graduate Studies govern the process of Graduate admission. These may be found in the Graduate Studies (http://catalog.ku.edu/graduate-studies) section of the online catalog. Please consult the Departments & Programs (http://catalog.ku.edu/liberal-arts-sciences) section of the online catalog for information regarding program-specific admissions criteria and requirements. Special admissions requirements pertain to Interdisciplinary Studies degrees, which may be found in the Graduate Studies section of the online catalog.

Graduate Admission

Ordinarily, admission requires an undergraduate grade-point average of at least B (3.0 on a 4.0 scale), overall and in the major. A baccalaureate degree with a major in physics is desirable but not required. Recommended preparation consists of courses in mechanics, electromagnetic theory, thermal physics, introductory quantum mechanics, advanced laboratory, and at least one course in mathematics beyond differential equations. Working knowledge of computers and of an advanced programming language is helpful. A student with less than the recommended preparation may enroll in these courses for graduate credit.

Submit your graduate application online (http://www.graduate.ku.edu). Send all other requested application materials to the department:

The University of Kansas
Department of Physics and Astronomy
Graduate Secretary
1251 Wescoe Hall Dr.
1082 Malott Hall
Lawrence, KS 66045-7572

Ph.D. Degree Requirements

Undergraduate Preparation

All students must adhere to the General Requirements for all Graduate Degrees (http://physics.ku.edu/individualized-plan-of-study), which are part of each student’s Individualized Plan for ensuring student preparation.

Course Requirements

What follows are the default set of requirements for all Ph.D. candidates.

1. A total of 11 advanced lecture courses (33 hours of level 700 and above) is required. This excludes all seminars, classes taken as part of the Individualized Plan, and colloquia.

2. Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 711</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 811</td>
<td>Quantum Mechanics II</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 821</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 831</td>
<td>Electrodynamics I</td>
<td>3</td>
</tr>
</tbody>
</table>

3. Other required courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 717</td>
<td>Graduate Seminar</td>
<td>1</td>
</tr>
<tr>
<td>PHSX 718</td>
<td>Mathematical Methods in Physical Sciences</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 815</td>
<td>Computational Methods in Physical Sciences</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 871</td>
<td>Statistical Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 931</td>
<td>Electrodynamics II</td>
<td>3</td>
</tr>
</tbody>
</table>

4. Two additional PHSX lecture courses numbered 700 or above. This excludes PHSX 815 (computational physics) and PHSX 717 (graduate seminar). The 2 courses must be in different sub-fields of physics and may not be used to simultaneously satisfy other degree requirements in force.

5. One credit hour of Colloquium is required (PHSX 700). See “Colloquium and Graduate Seminar for an explanation.”

6. All graduate students, after their first semester, will deliver at least 1 oral presentation per semester.

The courses listed above comprise the Department course requirements common to all students except those pursuing a multi-disciplinary plan of study, which is described below. Subsequent work, consisting of advanced courses in appropriate fields and seminars, will be selected by the student and the advisor on the basis of the student’s need and intended field of specialization. The student’s dissertation committee will determine the adequacy of the student’s courses and seminars and will specify the total course requirements.

Students who wish to pursue a more multidisciplinary plan of study may incorporate coursework from up to 2 other natural science, engineering, or mathematics (STEM) departments at KU by substituting non PHSX courses at the 600 level and above from these other disciplines for the 2 additional electives described in items 3 and 4 above. The research advisor, or in the absence of 1, the Departmental Graduate Advisor (who is the default advisor for all students without a research advisor), shall approve all such outside course choices and provide documentation for the student file on the approved courses and their rationale.
Students who wish to take courses in the social sciences, humanities, or professional schools must submit a detailed plan of study that must be approved by the Physics and Astronomy Graduate Committee. Please note that while these unique plans involving non-STEM fields will be considered, there is no guarantee that the plan of study will be approved.

**Preliminary Candidacy**

To be admitted to preliminary candidacy, each graduate student must satisfy the following department requirements:

1. Within 12 months of entering the program the student must fulfill the requirements of the individualized plan of study (http://physics.ku.edu/individualized-plan-of-study) for all graduate degrees to certify an undergraduate knowledge of Physics. Visit the Department's website for more information on those requirements and the process of certification.

2. Achieve a minimum core course grade point average of 3.2. The core course GPA is computed from the following equally weighted elements:
   a. Grade obtained in PHSX 711 Quantum Mechanics I
   b. Grade obtained in PHSX 811 Quantum Mechanics II
   c. Grade obtained in PHSX 821 Classical Mechanics
   d. Grade obtained in PHSX 831 Electrodynamics I
   e. Average grade of 2 other PHSX lecture courses numbered 700 or higher, excluding PHSX 815 (computational physics) and PHSX 717 (graduate seminar).

3. Students may repeat of the core courses (PHSX 711, PHSX 811, PHSX 821, PHSX 711, PHSX 821, and PHSX 831) once for the purpose of improving the core GPA. In calculating the core GPA, the Department will use only the better of the two grades.

4. The two additional 700 level or higher PHSX lecture courses (#4 under course requirements) must be taken at KU, but students entering with graduate credit from other institutions may petition the Graduate Committee for a waiver for any of the 4 named core courses. For the purposes of the core GPA, grades (of "B" or better) from the previous institution may be used for at most 3 of the 4 named courses.

5. Graduate students are normally expected to complete all core courses by the end of their second year of enrollment.

**Decision on Preliminary Candidacy**

Once requirements for Preliminary Candidacy have been met, the Graduate Committee will decide whether or not to admit the student to Preliminary Candidacy. Once requirements for Preliminary Candidacy have been met and confirmed by the Graduate Committee, the Graduate Committee Chair will report this result to the Graduate Faculty.

**Research Skills and Responsible Scholarship**

By the end of 1 year after being admitted to preliminary candidacy, the student must complete PHSX 815/ASTR 815, Computational Physics and Astronomy, with a grade of "B" or higher in order to satisfy the Research Skills requirement. Note that this course has significant prerequisites in undergraduate Computer Science. The Responsible Scholarship requirement is filled via completion of PHSX 717.

**Pedagogical Instruction**

Every student who receives a GTA appointment will be required to complete PHSX 702 at the first offering of the course starting with the semester of the student's initial GTA appointment. Failure to complete this class at the first opportunity may affect consideration for subsequent GTA appointments.

**Comprehensive Examination**

After completing a major portion of the required course work and satisfying the computing skills requirement, the student must pass the comprehensive examination.

The student will write a 2,000 to 4,000 word paper on a topic in their chosen sub-field that is relevant to their thesis work.

**Post-Comprehensive Requirements**

Upon passing the comprehensive examination, the student becomes a candidate for the Ph.D. degree. Each candidate must complete a research project that has been approved by the dissertation committee. The committee establishes the candidate's course requirements and directs the research.

At least once each year after passing the comprehensive examination, the student must schedule a meeting with his or her dissertation committee to discuss progress towards the completion of the dissertation and any other concerns.

**Final Oral Examination**

To be awarded the PhD in Physics, a candidate for the degree must complete a dissertation and pass a final oral examination.

The departmental web page with some additional information, e.g., the Graduate Handbook and milestones, can be found at http://physics.ku.edu/graduate-studies