Requirements - Ph.D. in Physics

Residency Requirements

To become a Ph.D. candidate, i.e. to take the comprehensive exam:

The student must spend at least two semesters, which may include one summer session, in resident study at the University of Kansas.

To obtain a Ph.D.:

The student must spend at least the equivalent of three full academic years in graduate study at this or another approved institution or laboratory. During this period of residence, the student must be involved full-time in academic or professional pursuits, which may include an appointment for teaching or research if the teaching/research is directed specifically toward the student's degree objectives.

Time Limits

Please go to this website to see the University's policy on time limits:
https://documents.ku.edu/policies/Graduate_Studies/docprogramtimeconstraints.htm

Graduate Teaching Assistantship Eligibility

To be eligible for teaching assistantships, all graduate students who are not native speakers of English must achieve a minimum score of 50 on the SPEAK test. International students must pass an oral examination to demonstrate English fluency. Students who fail this examination should take courses from the Applied English Center.

Milestones Towards PhD

There are a set of milestones on the way to completing a PhD degree in the department. Each of these milestones has an associated deadline. Failure to meet any of these milestones by its deadline may result in the loss of funding (TA- or RA-ships) and/or in the denial of candidacy for the Ph.D. Completion of all milestones at earliest possible time is encouraged. The milestones are summarized here in order of their occurence and explained in more detail below:

1. All graduate students are expected to have passed the speaking test (if relevant) within two years since entering the PhD program and to have carried out a minimum of one semester of being a TA in the department.
2. Admission to preliminary candidacy for a Ph.D. usually occurs within the first 2-3 years. There is no exam requirement for entrance into preliminary candidacy.
3. Students must pass an oral comphrehensive examination that includes a proposal of a plan for Ph.D. research and an oral presentation of this plan. The

comprehensive exam also includes a general knowledge component based on all previous coursework. This exam usually occurs in the fourth year.
4. A written dissertation must be completed and defended in an oral examination.

Pre-comprehensive Milestones

1. Within 12 months of entering the program the student must fulfill the undergraduate physics certification requirement for all graduate degrees.
2. Within 2 years of entering the program the student must fulfill requirements for preliminary candidacy. A student who did not fulfill their undergraduate requirement (See general requirements) before entering the program may take 3 years to fulfill the requirements for preliminary candidacy.
3. Within the first 6 months after being granted preliminary candidacy, the student should present a short (1-2 pages) written report to the Graduate Director and the Graduate Advisor detailing his/her efforts and progress in exploring research opportunities within the Department relevant to a possible Ph.D. research topic.
4. Before the end of a 12 month period following the preliminary candidacy, the student is expected to join a research group in the department, or, at least to have spent significant effort in seeking a thesis advisor. Again, a brief (1-2 pages) written report should be presented to the Graduate Director and the Graduate Advisor by the end of this time period.
5. By 12 months following the entrance into preliminary candidacy, the student should have completed almost all lecture course work and begun preparing for the comprehensive examination.
6. Before the end of an 18 month period following preliminary candidacy the student should have chosen an advisor, have completed the comprehensive exam, and should be carrying out Ph.D. research. A dissertation committee must be assembled, usually comprising the members of the comprehensive exam committee.

Post-comprehensive Milestones

7. The student is now a Ph.D. candidate and must abide by the rules for post-comprehensive enrollment. In brief summary, the student will schedule a meeting with their dissertation committee every 12 months after admission to preliminary candidacy. A report generated by the committee (not the student) must be distributed according to the detailed requirements.
8. The student will prepare a dissertation based on the student's original research, which must be satisfactory to the departmental members of the dissertation committee, and will defend it in a final oral examination before the dissertation committee. This examination is open to the public.

Course Requirements for Ph.D.

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

A total of 11 courses (33 hours) of advanced lecture courses are required. This excludes all seminars and colloquia.

a. Core courses
   - **PHSX 711** Quantum Mechanics I
   - **PHSX 811** Quantum Mechanics II
   - **PHSX 821** Classical Mechanics
   - **PHSX 831** Electrodynamics I

b. Other required courses
   - **PHSX 717** Graduate Seminar (satisfies Responsible Scholarship requirement)
   - **PHSX 718** Mathematical Physics
   - **PHSX 815** Computational Physics (satisfies Research Skills requirement)
   - **PHSX 871** Statistical Physics I
   - **PHSX 931** Electrodynamics II

c. Two additional PHSX lecture courses (Numbered 700 or above). This excludes PHSX 815 (computational physics) and 717 (graduate seminar). The two courses must be in different sub-fields of physics and they may not be used to simultaneously satisfy other degree requirements in force. (For example, if PHSX 911 is being used to satisfy the PHSX 811 core requirement, it may not also be used for this requirement.)

d. One additional advanced PHSX lecture course (Numbered 800 or above; excluding 815)

e. One credit hour of Colloquium is required (PHSX 700).

f. All graduate students, after their first semester, will deliver at least one oral presentation per semester. The guidelines are listed here.

g. A Ph.D. student who has not had the equivalent of 6 credit hours of advanced undergraduate laboratory course work (Junior/Senior level) is required to take one of the four advanced laboratory courses offered in the Department. Other experimental work (for example, senior thesis or undergraduate research experience) may be considered toward meeting this requirement.
   - **PHSX 516** Physical Measurements I
   - **PHSX 536** Electronic Circuits and Measurements
   - **PHSX 616** Physical Measurements II
   - **PHSX 636** Electronics Designs

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. There is no foreign language requirement. Subsequent work, consisting of advanced courses in appropriate fields and seminars, will be selected by the student and the adviser on the basis of the student's need and intended field of specialization. There is no prescribed minimum number of hours for the Ph.D. degree. The student's dissertation committee will determine the adequacy of the student's courses and seminars and will specify the total course requirements. Neither the Graduate School nor the Department has a requirement for a minor.

Students who wish to pursue a more multidisciplinary plan of study may incorporate coursework from up to two other natural science, engineering, or mathematics (SEM) departments at KU by substituting non PHSX courses at the 600 level and above from these other disciplines for the three additional electives described in items c and d above. The research advisor, or in the absence of one, 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 SEM fields will be considered, there is no guarantee that the plan of study will be approved.

Suggested course schedule

A sample academic schedule for a student who has a half-time teaching or research assistantship during the first four semesters is shown below. It includes the core courses for admission to preliminary candidacy (described in a subsequent section) and a set of lecture courses that meet the Ph.D. course requirements. It is the schedule for a full-time resident student with the normal preparation described above and who is working toward the Ph.D. degree. Students admitted with less preparation should begin with less advanced courses. Courses numbered 500 and above carry graduate credit.

The electives listed below, e.g. 741, 781, 795, 911, are purely an illustrative option. Students have the freedom to choose which non-required courses satisfy their elective requirements. Note that this sample schedule may also not apply for a student pursuing a more multidisciplinary plan of study.

FIRST SEMESTER		**SECOND SEMESTER**	
711 Quantum Mechanics I	3	811 Quantum Mechanics II	3
718 Mathematical Physics	3	815 Computational Physics	3
821 Classical Mechanics	3	831 Electrodynamics I	3
717 Graduate Seminar	1		

THIRD SEMESTER		FOURTH SEMESTER	
781 Solid State Physics	3	741 Nuclear Physics	3
911 Quantum Mechanics III	3	795 Space Plasma Physics	3
931 Electrodynamics II	3	871 Statistical Physics I	3

Colloquium and Graduate Seminar

All Ph.D. students are required to enroll in PHSX 700, Colloquium, in their sixth semester as an enrolled Physics and Astronomy graduate student. Students need to have attended at least 75% of the regularly scheduled colloquia during their six semesters to achieve a passing grade.

In Fall of the first year, each graduate student is required to enroll in and attend the graduate seminar (PHSX 717) in order to familiarize themselves with research programs in the Department and gain experience in oral presentations.

Research Skills and Responsible Scholarship

By the end of one year after being admitted to preliminary candidacy, the student must complete PHSX/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.

Admission to Preliminary Candidacy

To be admitted to preliminary candidacy for the Ph.D. degree, each graduate student is expected to satisfy the following Departmental requirements.

1. Completion of undergraduate physics certification requirement for MS or PhD degrees in Physics.

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

a. Students may repeat one of the four core courses (711, 811, 821, and 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.

b. The two "other PHSX lecture courses numbered 700 or higher" must be taken at KU, but students entering with graduate credit from other institutions may petition the Graduate Committee for transfer credit for any of the four 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 three of the four named courses. For the remaining course the student must obtain written certification of "B" performance or better from the instructor of the course at KU. Such certification may be obtained by taking the course, taking the final exam of the course (if there is one), or other means which may be determined by the instructor. An appropriate higher level course may also be used to obtain certification in a core course (for example 911 for 711 or 811, 931 for 831.)

c. Graduate students are normally expected to complete **all** core courses by the end of their second year of enrollment. Students who are required to complete an undergraduate physics certificate have three years to finish their core courses. Extensive Applied English Center (AEC) courses, prolonged illness, or extended military service might provide exceptional circumstances.

Decision on Preliminary Candidacy:

Once Undergraduate requirementcores have been certified and sufficient information has been received regarding the required courses, the Graduate Committee will decide whether or not to admit the student to preliminary candidacy. This decision will be based upon the certification and on their core course GPA. The Graduate Committee Chair will report their decision to the Graduate Faculty.

The Comprehensive Examination

Graduate College requirements for the Comprehensive Examination can be found at https://documents.ku.edu/policies/Graduate_Studies/doccomprehensiveorals.htm.

After completing a major portion of the required course work and satisfying the computing skills requirement, the student must pass the comprehensive examination. The Department recommends at least five people for committee membership to the Graduate Division, which makes the final appointments. One committee member must come from outside of the Department to serve as a representative of the Graduate School. Requests to take the examination must be made to the Graduate Coordinator at least three weeks in

advance of the date of the examination.

The student will write a 2000 to 4000 word paper on a topic in their chosen sub-field that is relevant to their thesis work. This paper must be presented to the committee at least one week in advance of the scheduled oral exam. The student will make a presentation at the oral examination based upon this paper, and will be examined on the contents of the talk, the paper, and works listed in the paper's bibliography. The bibliography must include at least one recent article from a peer-reviewed journal not authored by the student or the student's advisor. In addition, the committee may ask questions at the oral examination that cover the entire field of physics plus any related material (such as mathematics or chemistry) considered relevant by the examining committee.

In order to pass the comprehensive exam, the student must receive passing grades on both the written and oral components of the exam. The overall grade on this examination, determined by the examining committee, will be "Honors," "Satisfactory," or "Unsatisfactory."

Comprehensive exam checklist

	Unsatisfactory	Basic	Intermediate	Advanced
Description of Research Areas				
Formulation of Hypothesis				
Design of Experiment and Calculations				
Knowledge of General Physics				

The checklist will be filled out after the comprehensive exam and retained as a part of the student's records. The student's thesis advisor will discuss the results with the student. A template form is available here.

Post-Comprehensive Requirements

Upon passing the comprehensive examination, the student becomes a candidate for the Ph.D. degree. The Graduate Division will then designate the candidate's dissertation committee based on the recommendation of the Department. Each candidate must complete a research project that has been approved by the committee. The committee establishes the candidate's course requirements and directs the research.

Unless granted a leave of absence, the candidate must be continuously enrolled full-time, including summer sessions, until all requirements for the degree are completed. During this time, the candidate must enroll in a minimum of 6 hours a semester and 3 hours a summer session until the completion of the degree or of 18 hours of post-comprehensive enrollment, whichever comes first. (Post-comprehensive enrollment may include the semester in which the comprehensive examination is passed.) After 18 hours of post-comprehensive enrollment, the candidate must continue to enroll each semester and each summer session until all requirements for the degree have been met. If the student petitions (at https://documents.ku.edu/policies/Graduate_Studies/gta_gra_enroll_dr_fewer_6.pdf) they can enroll for only one hour of credit in spring, summer, and fall and still maintain their GTA or GRA status.

At least once each year after passing the comprehensive examination, the student should schedule a meeting with his or her dissertation committee to discuss progress towards the completion of the dissertation and any other concerns. A report of the committee's consensus of the meeting should be prepared by a member of the committee other than the student's adviser and placed in the student's file. Copies are to be given to the Departmental Chairman, the Graduate Committee Chair, the Graduate Advisor, the Departmental Director of Graduate Studies, and the student.

Final Oral Exam

The final oral examination will proceed according to the regulations of Graduate studies. These can be found at https://documents.ku.edu/policies/Graduate_Studies/docfinaloral.htm.

We refer to these requirements below, as they appeared on September 24th, 2010, and we have inserted some modified requirements for those students who wish to pursue a more multidisciplinary dissertation topic.

It is the reponsibility of the student to make sure that they satisfy the current university requirements.

Completion of the dissertation is the culminating academic phase of a doctoral program, climaxed by the final oral examination and defense of the dissertation. In all but the rarest cases, tentative approval of the dissertation is followed promptly by the final oral examination. When the completed dissertation has been accepted by the committee in final draft form, and all other degree requirements have been satisfied, the chair of the committee requests the Graduate Division to schedule the final oral examination. This request must be made in advance of the desired examination by at least the period specified by the Graduate Division (normally at least three weeks). The submission of the request must allow sufficient time to publicize the examination so that interested members of the university community may attend. At least five months must elapse between the successful completion of the comprehensive oral examination and the date of the final oral examination.

The committee for the final oral examination must consist of at least five members (the members of the dissertation committee plus other members of the Graduate Faculty recommended by the committee chair and the department and appointed by the Graduate Division). The Chair of the committee and three of the other four members must have appointments of some type within the Physics and Astronomy department. One member must be from a department other than the Physics and Astronomy department. The outside member represents Graduate Studies and must be a regular member of the Graduate Faculty. Before the examination, the Graduate Division provides a list of responsibilities to the Graduate Studies representative. The Graduate Studies representative is a voting member of the committee, has full right to participate in the examination, and provides a written report on any unsatisfactory or irregular aspects of the examination to the committee chair, department chair, Graduate Division, and Graduate Studies.

For students (and only those students) who are pursuing a multidisciplinary plan of study -- as defined by their substitution of courses from other departments for PHSX electives as described in the Course Requirements section -- up to two members of the committee, including the one required outside member, may be faculty from other SEM departments with regular, adjunct, or courtesy appointments at KU. The Chair must have an appointment of some type within the Physics and Astronomy department. (Exception: if the primary appointment of the Chair is outside the department, then only one additional committee member may be outside the Department of Physics and Astronomy.) NOTE: It is assumed that these research projects may involve interaction between physics and one or more other SEM disciplines; therefore, the external faculty members may come from up to two different departments.

The Graduate Division ascertains whether all other degree requirements have been met and if reports of any previously scheduled final oral examinations have been submitted and recorded. Upon approval of the request, the final oral examination is scheduled at the time and place designated by the Graduate Division. This information must be published in a news medium as prescribed by the Graduate Faculty. Interested members of the university community are encouraged to attend these examinations.

For every scheduled final oral examination, the department reports to the Graduate Division a grade of Honors, Satisfactory, or Unsatisfactory for the candidate's performance. If an Unsatisfactory grade is reported, the candidate may be allowed to repeat the examination on the recommendation of the department.

All Graduate College requirements can be found at http://www.graduate.ku.edu/06-00_abt_policies-processes.shtml