PHYSICS (PHD)

Department Website (http://as.nyu.edu/physics/)

NYSED: 08334 **HEGIS:** 1902.00 **CIP:** 40.0801

Program Description

Physicists come in many forms. Some love tinkering and may be natural experimentalists, some are drawn to elegant theories, some delight in writing computer codes, some have a special talent for communicating science to others, etc. And physicists do many different things in their lives, from public education, to academic research, to industry and tech, to public service and beyond. The goal of the NYU Graduate Program in Physics is to provide outstanding training to a student body which reflects the diversity of backgrounds, talents and skills of the next generation of aspiring physicists, astrophysicists and biophysicists. We want every member of the Department to flourish and find their own path. Our graduate admissions process aims to bring in a capable and committed group of students who are well-positioned to benefit from the training we can provide. No single metric gives a valid and accurate gauge for every person. To that end, admissions decisions are based on the full scope of information in the application dockets, and any individual component is considered in relation to its relevance for the student's aims.

The Department of Physics offers courses leading to the degrees of Master of Science and Doctor of Philosophy. There are opportunities for study and research in both experimental and theoretical physics. Areas of specialization include astrophysics and cosmology, atomic and molecular physics, condensed matter physics, elementary particle physics, quantum field theory and string theory, quantum optics, and statistical physics. Through ongoing faculty recruitment efforts the department continues to develop existing active research efforts and expand into new areas. The PhD program is aimed at enabling a student to prepare for and carry out research in physics at the frontier of knowledge. The department encourages entry into doctoral research under the supervision of a faculty member as soon as one has attained sufficient mastery of the fundamental principles and techniques of physics. Depth and breadth within the larger context of contemporary physics are promoted by a flexible set of course requirements.

Applications for admission to the Masters and Doctoral programs in Physics should be submitted to the Graduate School of Arts and Science (https://as.nyu.edu/nyu-as/gsas/admissions/gsas-application-resource-center.html). We encourage all applicants to review our Frequently Asked Questions (https://as.nyu.edu/nyu-as/as/departments/physics/programs/graduate/physics-graduate-admissions-faq.html) page for answers to the most commonly asked questions, including how to qualify for an application fee waiver (http://gsas.nyu.edu/admissions/gsas-application-resource-center/nyu-gsas-general-application-policies.html#2).

Dual Degree

The Physics Department offers a dual degree with the NYU School of Law: (https://www.law.nyu.edu/jdadmissions/dualdegreeprograms/jdma/) Physics PhD/Law JD.

See Physics (https://gsas.nyu.edu/admissions/arc/programs/physics.html) for admission requirements and instructions specific to this program.

Admissions

All applicants to the Graduate School of Arts and Science (GSAS) are required to submit the general application requirements (https://gsas.nyu.edu/nyu-as/gsas/admissions/arc.html), which include:

- Academic Transcripts (https://gsas.nyu.edu/nyu-as/gsas/admissions/arc/academic-transcripts.html)
- Test Scores (https://gsas.nyu.edu/nyu-as/gsas/admissions/arc/test-scores.html) (if required)
- Applicant Statements (https://gsas.nyu.edu/nyu-as/gsas/admissions/arc/statements.html)
- Résumé or Curriculum Vitae
- Letters of Recommendation (https://gsas.nyu.edu/nyu-as/gsas/admissions/arc/letters-of-recommendation.html), and
- A non-refundable application fee (https://gsas.nyu.edu/admissions/arc.html#fee).

See Physics (https://gsas.nyu.edu/admissions/arc/programs/physics.html) for admission requirements and instructions specific to this program.

Program Requirements

Course	Title	Credits
Major Requirements		
PHYS-GA 2000	Computational Physics	4
PHYS-GA 2002	Statistical Physics	4
PHYS-GA 2005	Electromagnetism I	4
PHYS-GA 2011	Classical and Quantum Mechanics I	4
PHYS-GA 2012	Classical and Quantum Mechanics II	4
Experimental Physics Requirement		4
Electives		
Physics Electives		16
Other Elective Credits		32
Total Credits		**72**

Additional Program Requirements

Formation of a Core Thesis Committee

By the beginning of May of the student's second year, the student is expected to have arranged for thesis supervision with a member of the physics faculty of the student's host campus. A four-person core thesis committee, chaired by the thesis adviser, is set up at this time. The membership of the thesis committee is proposed by the adviser in consultation with the student and must be approved in writing by the director of graduate studies to ensure breadth and level of expertise. At the time of its formation, the thesis committee meets with the student and discusses the student's course of study, preliminary research plans, and the timing and scope of the oral qualifying examination (see below). The committee conducts an annual review of the student's progress, normally in January.

Oral Qualifying Examination

The qualifying examination marks the student's formal entry into dissertation research under the supervision of a particular faculty member. It takes place after the student has already embarked on some sort of preliminary research with his or her adviser and is administered by the student's thesis committee. The deadline for taking the oral qualifying

examination is May 15th of a student's third year, prior to the annual review.

The examination itself consists of a prepared talk by the candidate followed by a question period. The aim is to examine the student's mastery not only of the specific area of the student's intended research, but also of related areas of physics and of (relevant) general principles of physics. The committee decides whether the evidence, taken all together, presents a convincing picture of a person with the preparation and skills needed to do original scientific research in the proposed area.

Annual Review, Progress Report, Thesis Proposal

There is an annual review of each student's progress toward the PhD. This includes a progress report submitted by the student. Prior to the formation of a thesis committee, the review is conducted by the student's academic and research advisors. Afterward, the student's thesis committee conducts the review. The first annual progress report following the qualifying examination includes a formal proposal for the student's thesis research. Subsequent progress reports inform the committee on progress toward completion of the thesis, as well as on any significant modifications of the original proposal.

Oral Thesis Defense

The final approval of the student's thesis and the oral thesis defense is conducted by the student's core thesis committee, augmented by one additional faculty member. Three members of the examining committee, including the student's adviser, serve as readers of the dissertation.

Additional Requirements

Students are strongly encouraged to attend the weekly departmental colloquia, which highlight progress in cutting-edge research areas of broad and general interest. The department holds weekly seminars in astrophysics, particle physics, atomic optical and molecular physics, nonlinear dynamics, condensed matter physics, theoretical physics, relativity, and cosmology. Distinguished lectures endowed by the James Arthur and Stanley H. Klosk Funds are held periodically. Informal interactions and "journal clubs"—where students, postdoctoral researchers, and faculty discuss research in progress—promote collaboration within and across subfields. Interaction is also fostered with programs at the Courant Institute of Mathematical Sciences, the Center for Neuroscience (program for theoretical neuroscience), the School of Medicine, and the Departments of Chemistry and Biology.

General Program Information

In order to make satisfactory progress toward the PhD, a student must complete all core course requirements by the beginning of his or her second year. If a student fails to get a B or better in a core course (or in one of the alternative options) during his or her first academic year, the student is obliged to take the relevant preliminary examination just prior to his or her second year. If one or more of the core course requirements are not satisfied at the start of the student's second year, the PhD Candidacy Committee will review the student's entire record and decide what action to take. Such action might include a recommendation to the faculty that the student be discontinued from the PhD program. Termination of a student from the program requires a vote of the faculty.

A student who has taken a course elsewhere that is equivalent to one of the core courses need not enroll in that course; instead, he or she may satisfy the requirement by achieving a grade of B or better on the relevant preliminary examination given just before the start of the fall (Classical and Quantum Mechanics 1, Electromagnetism) and spring (Classical and Quantum Mechanics 2, Statistical Physics) terms. Each examination is designed to be completed in two hours (three hours are allowed to avoid time pressure) and covers the material of the corresponding course at the level of midterm and final examinations.

Students are also required to have experience in experimental physics. This requirement may be satisfied by demonstrating past experience or by taking the course PHYS-GA 2075 Advanced Experimental Physics. Alternatively, a student may conduct an independent experimental project under physics faculty supervision.

Course Requirements Beyond the Core: A student is required to take at least four courses beyond the core level (not including reading and research courses or PHYS-GA 2090 Practicum in Teaching Physics) in the Department of Physics. At least two of these courses must be outside the student's research area.

Sample Plan of Study

Course	Title	Credits
1st Semester/Term		
PHYS-GA 2000	Computational Physics	4
PHYS-GA 2005	Electromagnetism I	4
PHYS-GA 2011	Classical and Quantum Mechanics I	4
	Credits	**12**
2nd Semester/Term		
PHYS-GA 2002	Statistical Physics	4
PHYS-GA 2012	Classical and Quantum Mechanics II	4
PHYS-GA 2090	Practicum in Teaching Physics	0
	Credits	**8**
3rd Semester/Term		
Advanced Experimental Physics		4
PHYS-GA ----	Physics Elective	4
PHYS-GA ----	Physics Research	4
	Credits	**12**
4th Semester/Term		
PHYS-GA ----	Physics Elective	4
PHYS-GA ----	Physics Research	8
	Credits	**12**
5th Semester/Term		
PHYS-GA ----	Physics Elective	4
PHYS-GA ----	Physics Research	8
	Credits	**12**
6th Semester/Term		
PHYS-GA ----	Physics Elective	4
PHYS-GA ----	Physics Research	8
	Credits	**12**
7th Semester/Term		
PHYS-GA ----	Physics Elective	4
	Credits	**4**
	Total Credits	**72**

Following completion of the required coursework for the PhD, students are expected to maintain active status at New York University by enrolling in a research/writing course or a Maintain Matriculation (MAINT-GA 4747) course. All non-course requirements must be fulfilled prior to degree conferral, although the specific timing of completion may vary from student-to-student.

Learning Outcomes

Upon successful completion of the program, graduates will have:

1. Mastery of fundamental technical and mathematical knowledge of foundational areas of Physics. This includes mastering of Classical Electromagnetism, Dynamics, Statistical Mechanics and Quantum Mechanics, as well as being fluent in the use of numerical techniques applied to solutions of physical problems.
2. A full understanding of and familiarity with experimental techniques such as setting up an experiment, analyzing data, separating spurious effects from data.
3. Mastery of advanced techniques, either theoretical, mathematical or experimental, specific to the area of specialization of the student.
4. The ability to perform supervised research on an assigned research topic, either in an experimental setting or in a theoretical setting.
5. The ability to conduct autonomous, unsupervised research on original material, either independently or collaboratively.
6. The ability to communicate results of research to peers and various audiences.
7. A full grasp of the relevance and position of the student's research within its area of specialization.
8. Mastery in presenting research results in specialized journals and conference proceedings.

Policies

NYU Policies

University-wide policies can be found on the New York University Policy pages (https://bulletins.nyu.edu/nyu/policies/).

Graduate School of Arts and Science Policies

Academic Policies for the Graduate School of Arts and Science can be found on the Academic Policies page (https://bulletins.nyu.edu/graduate/arts-science/academic-policies/).