

PHYSICS, PHD

Banner Code: SC-PHD-PHYS

Graduate Advisor

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The degree program contains a Standard concentration for traditional physics programs that focus on Astrophysics, Condensed Matter Theory, Dynamical Systems/Biological Physics, High Energy Physics, Materials Physics, Space Sciences, and an Engineering Physics concentration that combines the disciplines of physics, mathematics, and engineering. The doctoral students accepted into each concentration of the Physics PhD program take a required set of core courses for the given concentration (see Requirements tab).

By working with the dissertation committee, a student in the Standard concentration may choose to specialize in an emphasis area such as Astrophysics, Atomic Molecular and Optical Physics, Condensed Matter Experiment, Condensed Matter Theory, Dynamical Systems/Biological Physics, High Energy Physics, Materials Physics, Space Sciences, or others according to his or her particular interests. A student in the Engineering Physics concentration may choose to specialize in Applied Mechanics (Fluids and Solids), or other applied and engineering physics areas. By the end of their first year, all students should pair with a faculty advisor who will guide them toward doctoral candidacy.

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Graduate Admissions Policies (<http://catalog.gmu.edu/admissions/graduate-policies/>) section of this catalog.

To apply for this program, please complete the George Mason University Admissions Application (<https://www2.gmu.edu/admissions-aid/apply-now/>).

Those holding a baccalaureate degree in physics, astronomy, or engineering from an institution of higher education accredited by a Mason-recognized U.S. institutional accrediting agency or international equivalent who earned a GPA of 3.00 (out of 4.00) or higher in their last 60 credits are invited to apply for admission.

The GRE-GEN is required; however, this requirement is waived if the student has received a master's degree from an institution of higher education accredited by a Mason-recognized U.S. institutional accrediting agency or international equivalent. The GRE subject test in physics is not required.

Three letters of recommendation must be submitted, preferably from former professors.

A degree-seeking graduate applicant with a baccalaureate degree who has not met all admission requirements may be offered provisional

admission if sufficient evidence is presented to suggest that the applicant has the ability to pursue graduate work.

For more details concerning admission requirements to George Mason University please refer to Graduate Admission Policies (<http://catalog.gmu.edu/admissions/graduate-policies/>).

Policies

For policies governing all graduate programs, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Reduction of Credits

For students entering the doctoral program with a master's degree in a related field from an institution of higher education accredited by a Mason-recognized U.S. institutional accrediting agency or international equivalent, the number of required credits may be reduced up to 30 credits, subject to approval of the program faculty and the college's associate dean. See AP.6.5.2 Reduction of Credits (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-5-2>) for more information.

Requirements

Degree Requirements

Total credits: 72

Students should refer to the Admissions & Policies tab for specific policies related to this program.

Students must first choose one concentration, then continue with the additional sections:

Standard Concentration (STND)

Code	Title	Credits
Core Courses		12
PHYS 684	Quantum Mechanics I	
PHYS 685	Classical Electrodynamics I	
PHYS 705	Classical Mechanics	
PHYS 711	Statistical Mechanics	
Specialty Science Courses ¹		6
Select two of the following courses:		
ASTR 680	Physics of Interstellar Media	
ASTR 730	Stellar Astrophysics	
PHYS 784	Quantum Mechanics II	
PHYS 785	Classical Electrodynamics II	
Seminar Course		3
PHYS 703	Seminar in Physics (must be taken three times)	
Total Credits		21

Engineering Physics Concentration (ENGP)

Code	Title	Credits
Core Courses		12
PHYS 510	Computational Physics I	

PHYS 613	Computational Physics II	
PHYS 620	Continuum Mechanics	
PHYS 690	Engineering Thermodynamics	
Specialty Science Courses ¹		6
Select two of the following courses:		
PHYS 640	Finite Element Analysis of Solids and Fluids	
PHYS 694	Applied Mechanics of Solids	
PHYS 695	Applied Fluid Mechanics	
PHYS 684	Quantum Mechanics I	
PHYS 685	Classical Electrodynamics I	
Seminar Courses		3
PHYS 703	Seminar in Physics (at least one credit required)	
And any other graduate-level PHYS/CEIE/MECH/MATH/CSI seminar		
Total Credits		21

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These electives must be approved by the student's advisor or the graduate coordinator.

General Science Electives

Code	Title	Credits
Students in both the Standard Concentration and Engineering Physics Concentration must complete 27 credits of approved general electives and preliminary research credits: ²		27
ASTR 796	Directed Reading and Research	
ASTR 798	Research Project	
PHYS 796	Directed Reading and Research	
PHYS 798	Research Project	
Any graduate-level course chosen from PHYS/ASTR courses ³		
Total Credits		27

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PHYS 796 Directed Reading and Research/ASTR 796 Directed Reading and Research may be repeated as needed.

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General elective courses may be chosen from PHYS/ASTR courses, and/or other related disciplines as approved by the student's advisor or dissertation committee.

Qualifying Examination

All students must successfully pass the four individual sections required for each concentration of a qualifying examination. For the Standard Concentration, the four topics on the qualifying exam are covered in the four core courses (PHYS 684 Quantum Mechanics I, PHYS 685 Classical Electrodynamics I, PHYS 705 Classical Mechanics, and PHYS 711 Statistical Mechanics). For the Engineering Physics Concentration, the four topics on the qualifying exam are covered in the four core courses (PHYS 690 Engineering Thermodynamics or PHYS 711 Statistical Mechanics, PHYS 620 Continuum Mechanics or PHYS 705 Classical Mechanics, PHYS 510 Computational Physics I and PHYS 613 Computational Physics II) and in one of the specialty science courses (PHYS 694 Applied Mechanics of Solids or PHYS 695 Applied Fluid Mechanics).

All four sections of the qualifying exam will be offered twice a year, typically in the week before the start of the fall and spring semesters. A student can choose to take a particular section or a combination of sections at one sitting. Grades of "pass" or "unsatisfactory" will be given individually for each of the four sections of the exam. If a student receives a grade of "unsatisfactory" in a given section of the exam, he/she is allowed to retake that section in the next cycle, but a student must satisfactorily pass all sections of the exam by the end of the third year from the date of enrollment in the PhD program. Students entering the program with equivalent courses taken at another institution can satisfy a core course requirement by taking the associated qualifying exam without taking the course.

At the beginning of each academic year, the program director will appoint members to the qualifying examination committee. This committee is responsible for creating, administering, and grading the qualifying exams offered that year. Additional information and previous qualifying exams can be found on the departmental web page.

Dissertation Committee and Program of Study

Upon successful completion of the qualifying examinations, a dissertation committee should be formed by the student as soon as possible. The chair of this committee must be a graduate faculty member from the Department of Physics and Astronomy. The committee must include at least two additional members from the graduate faculty, one of whom must be from outside the Department of Physics and Astronomy. The composition of the committee must be approved by the program director. The dissertation committee is responsible for directing the student in their chosen field of research. The student should work closely with their committee to select specialty courses and electives that form a cohesive program of study. The student's program of study must be approved by the dean before advancement to candidacy.

Advancement to Candidacy

Before a student may be advanced to doctoral candidacy, he/she needs to complete all required coursework, pass the qualifying examination, have the program of study and dissertation proposal approved by the dean, and be recommended by the dissertation committee. Advancement to doctoral candidacy implies that the student has demonstrated adequate breadth and depth of knowledge in the field of study and is capable of conducting research on the boundaries of knowledge.

Dissertation Research

Note: No more than 24 combined credits from PHYS 998 Doctoral Dissertation Proposal/ASTR 998 Doctoral Dissertation Proposal and PHYS 999 Doctoral Dissertation/ASTR 999 Doctoral Dissertation may be applied toward satisfying the doctoral degree requirements, with no more than 21 credits of PHYS 998 Doctoral Dissertation Proposal/ASTR 998 Doctoral Dissertation Proposal.

Code	Title	Credits
Select 24 credits from the following:		
ASTR 998	Doctoral Dissertation Proposal	
ASTR 999	Doctoral Dissertation	
PHYS 998	Doctoral Dissertation Proposal	
PHYS 999	Doctoral Dissertation	
Total Credits		24

Doctoral Dissertation

After advancing to doctoral candidacy, the student works with their dissertation committee to develop their preliminary research into a doctoral dissertation. The dissertation research should represent a significant contribution to its scientific field and should be deemed publishable in a refereed scientific journal. The dissertation must be defended in a public forum before the dissertation committee and other interested faculty.