APPLIED AND ENGINEERING PHYSICS, MS

Banner Code: SC-MS-PHAE

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This degree contains elements of traditional physics programs and the application of physics to a diversity of critical societal problems. The program is divided into three areas of emphasis; see Requirements for details.

Many courses are offered during late afternoon or evening hours to allow students with full-time employment to easily attend. Students employed at area high-technology organizations may take up to 6 credits (out of 30) for work done on the job under the guidance of a faculty member. This employment-related research may be conducted under an optional 3-credit research project or an optional 6-credit master's thesis. Master's students who are not employed full time may apply for financial aid or a limited number of research assistantships.

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Graduate Admissions 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).

Individuals holding a baccalaureate degree in physics or a related field from a regionally accredited institution and who have earned a GPA of 3.00 (out of 4.00) in their last 60 credits are invited to apply for admission. If the baccalaureate degree is in a field other than physics, applicants should have taken several courses beyond the introductory physics courses, such as junior-level classical mechanics, electricity and magnetism, or electronics. Applicants may be required to make up one or two deficiencies, based on a graduate physics advisor's assessment, and be provisionally admitted into the program. Three letters of recommendation must be submitted, preferably from former professors. The general GRE and the GRE subject test in physics are recommended for applicants who received their baccalaureate degrees within the past five years.

Policies

For policies governing all graduate programs, see AP.6 Graduate Policies.

Requirements

Degree Requirements

Total credits: 30

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

Emphasis Requirement

Select one emphasis and complete all the requirements therein.

Standard Emphasis

This emphasis is intended for students who may wish to pursue further graduate study in physics leading to a PhD degree in preparation for a career in basic research.

PHYS 684  Quantum Mechanics I  3
PHYS 685  Classical Electrodynamics I  3
PHYS 705  Classical Mechanics  3
PHYS 711  Statistical Mechanics  3
Select 9 credits from the following:
ASTR 532  Phys Interplanetary Med  3
ASTR 602  Methods of Observational Astronomy  3
ASTR 603  Planetary Sciences  3
ASTR 604  Galaxies and Cosmology  3
ASTR 660  Plasma Physics for Space and Astrophysics  3
ASTR 680  Physics of Interstellar Media  3
ASTR 730  Stellar Astrophysics  3
ASTR 764  Computational Astrophysics  3
ASTR 765  High-Energy and Accretion Astrophysics  3
ASTR 790  Topics in Astronomy and Astrophysics  3
PHYS 510  Computational Physics I  3
PHYS 512  Solid State Physics and Applications  3
PHYS 533  Modern Instrumentation  3
PHYS 540  Nuclear and Particle Physics  3
PHYS 575  Atmospheric Physics I  3
PHYS 611  Electro-optics  3
PHYS 612  Physics of Modern Imaging  3
PHYS 613  Computational Physics II  3
PHYS 614  Thermodynamics and Kinetics of Materials  3
PHYS 615  Fundamentals of Materials Science  3
PHYS 620  Continuum Mechanics  3
PHYS 628  Relativity  3
PHYS 630  Introduction to Biophysics  3
PHYS 660  Space Weather  3
PHYS 684  Quantum Mechanics I  3
PHYS 685  Classical Electrodynamics I  3
PHYS 701  Theoretical Physics  3
PHYS 736  Computational Quantum Mechanics  3
PHYS 760  Space Plasma Physics  3
PHYS 780  Advanced Selected Topics in Physics  3
PHYS 784  Quantum Mechanics II  3
PHYS 785  Classical Electrodynamics II  3
CSI 720  Fluid Mechanics  3
CSI 721  Computational Fluid Dynamics I  3
CSI 722  Computational Fluid Dynamics II  
CSI 786  Molecular Dynamics Modeling  
CSI 787  Computational Materials Science  
CSI 788  Simulation of Large Scale Systems  

Total Credits 21  

**Engineering Physics Emphasis**  
This emphasis allows students to select a larger number of courses from electrical engineering and other areas.  

Choose one of the following:  

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 684</td>
<td>Quantum Mechanics I</td>
</tr>
<tr>
<td>PHYS 502</td>
<td>Introduction to Quantum Mechanics and Atomic Physics</td>
</tr>
<tr>
<td>PHYS 690</td>
<td>Engineering Thermodynamics</td>
</tr>
</tbody>
</table>

Choose one of the following:  

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>PHYS 685</td>
<td>Classical Electrodynamics I</td>
</tr>
<tr>
<td>PHYS 513</td>
<td>Applied Electromagnetic Theory</td>
</tr>
<tr>
<td>PHYS 620</td>
<td>Continuum Mechanics</td>
</tr>
<tr>
<td>PHYS 510</td>
<td>Computational Physics I</td>
</tr>
<tr>
<td>PHYS 533</td>
<td>Modern Instrumentation</td>
</tr>
<tr>
<td>PHYS 613</td>
<td>Computational Physics II</td>
</tr>
</tbody>
</table>

Select 9 credits of graduate-level PHYS, ECE, CEIE, or MATH courses  

Total Credits 21  

1  Advisor approval required  

**Applied Physics Emphasis**  
This emphasis is intended for those who wish to apply the techniques and subject areas of physics to multifaceted problems encountered in the workplace, particularly in physics, engineering, computational science, and other related areas.  

<table>
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</thead>
<tbody>
<tr>
<td>PHYS 510</td>
<td>Computational Physics I</td>
</tr>
<tr>
<td>PHYS 533</td>
<td>Modern Instrumentation</td>
</tr>
<tr>
<td>PHYS 684</td>
<td>Quantum Mechanics I</td>
</tr>
<tr>
<td>or PHYS 502</td>
<td>Introduction to Quantum Mechanics and Atomic Physics</td>
</tr>
<tr>
<td>PHYS 685</td>
<td>Classical Electrodynamics I</td>
</tr>
<tr>
<td>or PHYS 513</td>
<td>Applied Electromagnetic Theory</td>
</tr>
</tbody>
</table>

Select 9 credits from the following:  

<table>
<thead>
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<tr>
<td>PHYS 581</td>
<td>Topics in Renewable Energy</td>
</tr>
<tr>
<td>BINF 731</td>
<td>Protein Structure Analysis</td>
</tr>
<tr>
<td>BINF 741</td>
<td>Introduction to Computer Simulations of Biomolecules</td>
</tr>
<tr>
<td>CLIM 710</td>
<td>Introduction to Physical Climate System</td>
</tr>
<tr>
<td>CLIM 711</td>
<td>Introduction to Atmospheric Dynamics</td>
</tr>
<tr>
<td>CLIM 712</td>
<td>Physical and Dynamical Oceanography</td>
</tr>
<tr>
<td>CLIM 713</td>
<td>Atmosphere-Ocean Interactions</td>
</tr>
<tr>
<td>CLIM 714</td>
<td>Land-Climate Interactions</td>
</tr>
<tr>
<td>CLIM 715</td>
<td>Numerical Methods for Climate Modeling</td>
</tr>
<tr>
<td>CLIM 750</td>
<td>Geophysical Fluid Dynamics</td>
</tr>
<tr>
<td>CSI 742</td>
<td>The Mathematics of the Finite Element Method</td>
</tr>
<tr>
<td>CSI 763</td>
<td>Statistical Methods in Space Sciences</td>
</tr>
</tbody>
</table>

Total Credits 9  

1  No more than 6 credits may be chosen from areas outside ASTR, CSI, ECE, NANO, and PHYS.  

**Notes:**  
• Students may choose to take either PHYS 798 Research Project/ECE 798 Research Project or PHYS 799 Master’s Thesis/ECE 799 Master’s Thesis (6 credits), but not both. The research project may be conducted at a student’s place of employment with the concurrence of a faculty advisor.  
• The thesis is a more substantial piece of work performed under the supervision of a faculty member and requires students to make an oral defense. PHYS 798 Research Project/ECE 798 Research Project may be taken only once. No more than 6 credits of PHYS 799 Master’s Thesis may be applied to the degree.  
• Students in the master’s degree program can earn the Data Science Graduate Certificate from the Department of Computational and Data Sciences by choosing an approved sequence of courses.  

**Accelerated Master’s**  
**Physics, BS/Applied and Engineering Physics, Accelerated MS**  
**Overview**  
This program allows academically strong undergraduates with a demonstrable commitment to research to obtain the Physics, BS and Applied and Engineering Physics, MS degrees by successfully completing 144 credits. Upon completion, students are well-prepared for entry into a professional school or a PhD program in physics or a related discipline.
Admitted students take selected graduate courses during their senior year and are able to use up to 6 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program and complete an additional 24 credits to receive the master's degree.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

Application Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies section of this catalog.

Successful applicants will have completed at least 90 credits toward their undergraduate degree and 45 credits in physics major coursework. The physics major GPA must be at least 3.50. One or more recommendation letters from one or more research supervisors are also required. Interested applicants should submit a letter to the undergraduate physics coordinator requesting admission along with the aforementioned recommendation letter(s). Contact the physics undergraduate or graduate coordinator for further details.

Accelerated Option Requirements

At the beginning of the student's final undergraduate semester, students must submit a bachelor's/accelerated master's transition form (http://registrar.gmu.edu/forms) to the College of Science's Office of Academic and Student Affairs (https://cos.gmu.edu/about/contact-us). Students must begin their master's program in the semester immediately following conferral of the bachelor's degree.

Students must maintain an overall GPA of 3.00 or higher in graduate coursework.

Reserve Graduate Credit

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.