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.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 684</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 685</td>
<td>Classical Electrodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 705</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 711</td>
<td>Statistical Mechanics</td>
<td>3</td>
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</table>

Select 9 credits from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 532</td>
<td>Phys Interplanetary Med</td>
<td></td>
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<tr>
<td>ASTR 602</td>
<td>Methods of Observational Astronomy</td>
<td></td>
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<tr>
<td>ASTR 603</td>
<td>Planetary Sciences</td>
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<tr>
<td>ASTR 604</td>
<td>Galaxies and Cosmology</td>
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<tr>
<td>ASTR 660</td>
<td>Plasma Physics for Space and Astrophysics</td>
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<tr>
<td>ASTR 680</td>
<td>Physics of Interstellar Media</td>
<td></td>
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<tr>
<td>ASTR 730</td>
<td>Stellar Astrophysics</td>
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<td>ASTR 764</td>
<td>Computational Astrophysics</td>
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<tr>
<td>ASTR 765</td>
<td>High-Energy and Accretion Astrophysics</td>
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<tr>
<td>ASTR 790</td>
<td>Topics in Astronomy and Astrophysics</td>
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<tr>
<td>PHYS 510</td>
<td>Computational Physics I</td>
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<tr>
<td>PHYS 512</td>
<td>Solid State Physics and Applications</td>
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<tr>
<td>PHYS 533</td>
<td>Modern Instrumentation</td>
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<tr>
<td>PHYS 540</td>
<td>Nuclear and Particle Physics</td>
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<tr>
<td>PHYS 575</td>
<td>Atmospheric Physics I</td>
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<tr>
<td>PHYS 611</td>
<td>Electro-optics</td>
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<tr>
<td>PHYS 612</td>
<td>Physics of Modern Imaging</td>
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<td>PHYS 613</td>
<td>Computational Physics II</td>
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<tr>
<td>PHYS 614</td>
<td>Thermodynamics and Kinetics of Materials</td>
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<td>PHYS 615</td>
<td>Fundamentals of Materials Science</td>
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<td>PHYS 620</td>
<td>Continuum Mechanics</td>
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<td>PHYS 628</td>
<td>Relativity</td>
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<td>PHYS 630</td>
<td>Introduction to Biophysics</td>
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</tr>
<tr>
<td>PHYS 660</td>
<td>Space Weather</td>
<td></td>
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<tr>
<td>PHYS 684</td>
<td>Quantum Mechanics I</td>
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<tr>
<td>PHYS 685</td>
<td>Classical Electrodynamics I</td>
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<td>PHYS 701</td>
<td>Theoretical Physics</td>
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<td>PHYS 736</td>
<td>Computational Quantum Mechanics</td>
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<td>PHYS 760</td>
<td>Space Plasma Physics</td>
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<td>PHYS 780</td>
<td>Advanced Selected Topics in Physics</td>
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<tr>
<td>PHYS 784</td>
<td>Quantum Mechanics II</td>
<td></td>
</tr>
<tr>
<td>PHYS 785</td>
<td>Classical Electrodynamics II</td>
<td></td>
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<tr>
<td>CSI 720</td>
<td>Fluid Mechanics</td>
<td></td>
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<tr>
<td>CSI 721</td>
<td>Computational Fluid Dynamics I</td>
<td></td>
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</tbody>
</table>
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:  3  
- PHYS 684  Quantum Mechanics I  
- PHYS 502  Introduction to Quantum Mechanics and Atomic Physics  
- PHYS 690  Engineering Thermodynamics  

Choose one of the following:  3  
- PHYS 685  Classical Electrodynamics I  
- PHYS 513  Applied Electromagnetic Theory  
- PHYS 620  Continuum Mechanics  
- PHYS 510  Computational Physics I  3  
- PHYS 533  Modern Instrumentation  3  
- or PHYS 613  Computational Physics II  
- PHYS 685  Classical Electrodynamics I  3  
- or PHYS 513  Applied Electromagnetic Theory  

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

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.

- PHYS 510  Computational Physics I  3  
- PHYS 533  Modern Instrumentation  3  
- PHYS 684  Quantum Mechanics I  3  
- or PHYS 502  Introduction to Quantum Mechanics and Atomic Physics  
- PHYS 685  Classical Electrodynamics I  3  
- or PHYS 513  Applied Electromagnetic Theory  

Select 9 credits from the following:  9  
- PHYS 581  Topics in Renewable Energy  
- BINF 731  Protein Structure Analysis  
- BINF 741  Introduction to Computer Simulations of Biomolecules  
- CLIM 710  Introduction to Physical Climate System  
- CLIM 711  Introduction to Atmospheric Dynamics  
- CLIM 712  Physical and Dynamical Oceanography  
- CLIM 713  Atmosphere-Ocean Interactions  
- CLIM 714  Land-Climate Interactions  
- CLIM 715  Numerical Methods for Climate Modeling  
- CLIM 750  Geophysical Fluid Dynamics  
- CSI 742  The Mathematics of the Finite Element Method  
- CSI 763  Statistical Methods in Space Sciences  

Total Credits  21  

**Electives**  
Select nine elective credits from the following:  9  
- PHYS  
- CHEM  
- MATH  
- ECE  
- CSI  
- PHYS 798  Research Project  
- PHYS 799  Master’s Thesis  
- ECE 798  Research Project  
- ECE 799  Master’s Thesis  

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.