Program Change Request

Date Submitted: 03/07/25 2:43 pm

Viewing: **SC-MS-PHAE : Applied and Engineering Physics, MS**

Last approved: 04/26/24 1:06 pm

Last edit: 03/07/25 2:43 pm

Changes proposed by: jbazaz

Catalog Pages
Using this Program
   Applied and Engineering Physics, MS

Are you completing this form on someone else's behalf?
                Yes

Requestor:

In Workflow

1. **PHYS GR Committee**
2. **PHYS Chair**
3. **SC Curriculum Committee**
4. SC Assistant Dean
5. Assoc Provost-Graduate
6. Registrar-Programs

Approval Path

1. 03/07/25 2:44 pm
   Paul So (paso):
   Approved for PHYS
   GR Committee
2. 03/07/25 2:54 pm
   Ernest Barreto
   (ebarreto):
   Approved for PHYS
   Chair

History

1. Nov 14, 2017 by
   clmig-jwehrheim
2. Jan 16, 2018 by
   rzachari
3. Mar 6, 2018 by
   Jennifer Bazaz
   Gettys (jbazaz)
4. Mar 6, 2018 by
   pchampan
5. Mar 14, 2018 by
   rzachari
6. Mar 28, 2018 by
   rzachari

7. Mar 29, 2018 by
   rzachari
8. Jan 29, 2021 by
   Jennifer Bazaz
   Gettys (jbazaz)
9. Feb 23, 2021 by
   jriemen
10. Mar 31, 2023 by
    Jennifer Bazaz
    Gettys (jbazaz)
11. Apr 26, 2024 by
    Jennifer Bazaz
    Gettys (jbazaz)

Name	Extension	Email
Paul So	4377	paso@gmu.edu

Effective Catalog: 2025-2026

Program Level: Graduate

Program Type: Master's

Degree Type: Master of Science

Title: Applied and Engineering Physics, MS

Banner Title: Applied & Engineering Phys MS

Registrar/OAPI Use Only – SCHEV Status Approved

Registrar's Office Use Only – Program Start Term

Registrar/OAPI Use Only – SCHEV Letter

Registrar/OAPI Use Only – SACSCOC Status

Concentration(s):

	Associated Concentrations	Registrar's Office Use Only: Concentration Code
1	Standard Physics Concentration	STDP
2	Engineering Physics Concentration	ENGP
3	Applied Physics Concentration	APLP
4	Quantum Information Science and Engineering Concentration	QISE

Registrar/IRR Use Only – Concentration CIP Code

College/School: College of Science

Department / Academic Unit: Physics & Astronomy

Jointly Owned Program?   No

Justification

What: To replace ECE 646 Applied Cryptography with ECE 547 Applied Cryptography and to replace ECE 746 Advanced Applied Cryptography with ECE 647 Post-Quantum Cryptography & ECE 649 Side-Channel Security in the list of suggested ECE courses for the "Core Courses: Focus Area (Software)" in the PHAE MS QISE Concentration.

Why: Both ECE 646 and 746 have been recently deactivated. One of the replacement course ECE 647 is already listed in the 2024-2025 Catalog and the other two, ECE 547 and 649, have been recently approved for inclusion in the 2025-2026 Catalog.

Total Credits Required: Total credits: 30

Registrar's Office Use Only - Program Code:

SC-MS-PHAE

Registrar/IRR Use Only – Program CIP Code   40.0801 - Physics, General.

Admission Requirements:

Admissions

University-wide admissions policies can be found in the Graduate Admissions Policies section of this catalog. International students and students having earned international degrees should also refer to Admission of International Students for additional requirements.

Eligibility

Individuals holding a baccalaureate degree in physics or a related field from an institution of higher education accredited by a Mason-recognized U.S. institutional accrediting agency or international equivalent and who have earned a GPA of 3.00 (out of 4.00) are invited to apply for admission.

Applicants may be required to make up one or two course deficiencies, based on a graduate physics advisor's assessment, and be provisionally admitted into the program.

Application Requirements

To apply for this program, prospective students should submit the George Mason University Admissions Application and its required supplemental documentation, and three letters of recommendation, preferably from former professors.

The GRE general is optional.

Program-Specific Policies:

Policies

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

Transferring Previous Graduate Credit into this Program

Previously earned and relevant graduate credits may be eligible for transfer into this program; details can be found in the Credit by Exam or Transfer section of this catalog.

Degree Requirements:

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

Students should complete the core courses and select one concentration, completing all of the requirements therein.

Plan of Study

Before the beginning of their first semester, students are advised to meet with their academic advisor and develop a preliminary plan of study for the concentration they are interested in pursuing. A final plan of study must be approved by the graduate coordinator at the start of the semester in which the student graduates.

Core Courses

Students should choose their core courses in consultation with an advisor.

Choose one course from each grouping:

Group One: Computational Physics/Astrophysics		3
ASTR 601	Computer Simulation in Astronomy	
PHYS 510	Computational Physics I	
PHYS 534	Introduction to Quantum Computation and Quantum Information	
Group Two: Mechanics		**3**
PHYS 502	Introduction to Quantum Mechanics and Atomic Physics	
PHYS 620	Continuum Mechanics	
PHYS 684	Quantum Mechanics I	
Group Three: Electricity and Magnetism		**3**
PHYS 513	Applied Electromagnetic Theory	
PHYS 685	Classical Electrodynamics I	
Group Four: Statistical and Thermal Mechanics		**3**
PHYS 690	Engineering Thermodynamics	
PHYS 711	Statistical Mechanics	
Group Five: Methods in Physics		**3**
PHYS 591	Systems for Quantum Scientists	
PHYS 613	Computational Physics II	
PHYS 683	Mathematical Methods in Physics	
Total Credits		15

Standard Physics Concentration (STDP)

This concentration is intended for students who may wish to pursue further graduate study in physics or astrophysics or pursue graduate study following the Standard Physics concentration of the Physics PhD.

Core Course		3
PHYS 705	Classical Mechanics	
Concentration Electives		**3**

In consultation with an advisor, select 3 credits of graduate-level courses from the following course prefixes: [1]

ASTR	
PHYS	

General Electives	9
In consultation with an advisor, select 9 credits of graduate-level science courses. [2]	
Total Credits	15

[1]
- Courses must be approved by an advisor.
- Courses cannot be directed reading, research, or thesis credits.

[2]
- Courses must be approved by an advisor.
- Students may take PHYS 796 Directed Reading and Research and up to 6 credits of PHYS 798 Research Project as general electives. PHYS 798 Research Project is conducted under the supervision of a faculty research advisor and may be based on work done as an intern. Up to 6 credits of PHYS 799 Master's Thesis may be taken as general electives by students pursuing the thesis option and may also be based on work completed as an intern.

Engineering Physics Concentration (ENGP)

This concentration is intended for students who may wish to pursue employment in an engineering-related field or pursue graduate study following the Engineering Physics concentration of the Physics PhD.

Core Course	3
PHYS 640 Finite Element Analysis of Solids and Fluids	
Concentration Electives	3
In consultation with an advisor, select 3 credits of graduate-level courses from the following course prefixes: [1]	
PHYS	
MATH	
BENG	
CEIE	
ECE	
ME	
General Electives	9
In consultation with an advisor, select 9 credits of graduate-level science and engineering courses. [2]	
Total Credits	15

[1]
- Courses must be approved by an advisor.
- These must be regular courses and not directed reading, research, or thesis credits.

[2]
- Courses must be approved by an advisor.

- Students may take PHYS 796 Directed Reading and Research and up to 6 credits of PHYS 798 Research Project as general electives. PHYS 798 Research Project is conducted under the supervision of a faculty research advisor and may be based on work done as an intern. Up to 6 credits of PHYS 799 Master's Thesis may be taken as general electives by students pursuing the thesis option and may also be based on work done as an intern.

Applied Physics Concentration (APLP)

This concentration is intended for students who wish to pursue employment in an applied physics or engineering-related field.

Core Course	3
PHYS 533	Modern Instrumentation	

Concentration Electives	3

In consultation with an advisor, select 3 credits of graduate-level courses from the following course prefixes: [1]

PHYS
BINF
CHEM
CLIM
MATH
CSI
STAT

General Electives	9

In consultation with an advisor, select 9 credits of graduate-level science and engineering courses. [2]

Total Credits	15

[1]
- Courses must be approved by an advisor.
- These must be regular courses and not directed reading, research, or thesis credits.

[2]
- Courses must be approved by an advisor.
- Students may take PHYS 796 Directed Reading and Research and up to 6 credits of PHYS 798 Research Project as general electives. PHYS 798 Research Project is conducted under the supervision of a faculty research advisor and may be based on work done as an intern. Up to 6 credits of PHYS 799 Master's Thesis may be taken as general electives by students pursuing the thesis option and may also be based on work done as an intern.

Quantum Information Science and Engineering Concentration (QISE)

This concentration prepares students for the quantum information workforce through study of physics and courses across mathematics, computer science, electrical engineering, and mechanical engineering as appropriate for their career plans in this multidisciplinary field.

Core Course	3

Select a focus area and choose one course therein:

Focus Area: Software

PHYS 736	Computational Quantum Mechanics
MATH 621	Algebra I
MATH 641	Combinatorics and Graph Theory
MATH 674	Stochastic Differential Equations
CS 583	Analysis of Algorithms
CS 587	Introduction to Cryptography
CS 600	Theory of Computation
CS 630	Advanced Algorithms
CS 747	Deep Learning
ECE 508	Internet of Things
~~ECE 646~~	~~Course ECE 646 Not Found~~
ECE 547	Applied Cryptography
ECE 647	Post-Quantum Cryptography
ECE 649	Side-Channel Security
ECE 699	Advanced Topics in Electrical and Computer Engineering
~~ECE 746~~	~~Course ECE 746 Not Found~~
ECE 747	Cryptographic Engineering

Focus Area: Hardware

PHYS 512	Solid State Physics and Applications
PHYS 533	Modern Instrumentation
PHYS 611	Electro-optics
PHYS 784	Quantum Mechanics II
CHEM 579	Special Topics
CHEM 736	Computational Quantum Mechanics

ECE 685	Nanoelectronics	
ME 754	Introduction to Nano-Materials	
Research Project		**3**

Students in the QISE concentration are expected to gain hands-on experience either through an industry internship, externship research experience in a collaborating research laboratory, or research experience in a Mason research laboratory.

PHYS 798	Research Project	
General Electives		**9**

Select 9 credits of graduate-level science and engineering courses approved by an academic advisor. [1]

Total Credits	15

[1]
- Courses must be approved by an advisor.
- Students may take PHYS 796 Directed Reading as a general elective. Up to 6 credits of PHYS 799 Master's Thesis may be taken as general electives by students who would like a thesis option in addition to the research project.

Thesis Option

In preparation for this option, the student must form a committee comprising a chair and two other faculty members.

The student completes a thesis under the direction of the committee chair. The thesis work is typically completed while students are registered for 6 credits of PHYS 799 Master's Thesis. A thesis proposal and thesis are submitted in accordance with AP.6 Graduate Policies. The student must give an oral defense of the thesis to the committee and the George Mason University community at large. Students are expected to respond to questions on the thesis and related material. The committee determines whether the defense is satisfactory.

Retroactive Requirements Updates:

Plan of Study:

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Program Outcomes

Additional Program Information

This information is required by the Office of Accreditation and Program Integrity.

Courses offered via distance (if applicable):

What is the primary delivery format for the program?

Face-to-Face Only

Does any portion of this program occur off-campus?

No

Are you working with a vendor / other collaborators to offer your program?

No

Related Departments

Could this program prepare students for any type of professional licensure, in Virginia or elsewhere?

No

Are you adding or removing a licensure component?

No

Additional SCHEV & SACSCOC Information

Is this change a simple retitling of an existing program, with no other changes, to any existing program content, curriculum requirements, etc?

No

Does this change represent a repackaging of content in an existing approved degree/certificate program at the same instructional level (i.e., baccalaureate, master's, or doctoral)?

No

Percentage of total credits containing new course content. ("New course content" is defined by SACSCOC as content that is not currently included in an existing approved degree/certificate program at the same instructional level. Do not exclude gen ed credits in calculations for undergraduate programs.)

0%-24%

Does this change include the addition of a distance education or face-to-face method of delivery for this program?

No

Does this change include the addition of a course/credit-based competency-based education delivery option?

No

Will any additional equipment/facilities be needed?

No

Will any additional faculty be required?

No

Will any additional financial resources be needed?

No

Additional library/learning resources needed?

No

Have you reached out to the Libraries to determine whether there are adequate resources to support your program? If not, please email Meg Meiman, Associate University Librarian for Learning, Research, and Engagement at mmeiman2@gmu.edu.

OAPI Use Only – Determination of SACSCOC Impact

Comments or Notes

Green Leaf Program Designation

Is this a Green Leaf program?   No

Does this program cover material which crosses into another department?

No

Additional Attachments   msphae_001.pdf

SCHEV Proposal

Executive Summary

Reviewer Comments

Additional Comments

Is this course required of all students in this degree program?

%wi_required.eschtml%

Key: 347