

# APPLIED PHYSICS

## Degree: B.S., Physics

Department of Chemistry and Physics (<https://cas.umw.edu/physics/>)

The study of physics involves a basis for understanding more deeply all arenas of the physical universe. Because the discipline also provides a framework for problem-solving, studying physics also imports into other fields in/out of STEM disciplines where stubborn problems persist. An understanding of physics also transfers to every technical discipline that involves modern computation and instrumentation. In total, majoring in physics supplies undergraduates with a firm footing to better understand current STEM foundations while also feeding one's curiosity for solving future unforeseen problems.

The Applied Physics major at UMW is part of a nationally recognized program that emphasizes faculty accessibility and student collaboration. The program is keenly aware of the lack of equitable representation in physics and participates in a national cohort to address historical inequities. The whole program, from students to faculty, elevates awareness for physics education from grades K–12 through informal programming and partnership with UMW's College of Education. Our graduates have a high success rate of moving forward with their expected plans, which mirrors the national statistics for physics majors. Our faculty are contributing members of science abroad, while also collaborating with student majors. This process begins as early as a student's first year. UMW physics facilities are among the best, on-campus and beyond. The Margaret Duke ('44) Endowed Fund supports students in all facets of their journey toward aspiring scientists, including a monthly colloquium series that allows students to interact personally with disciplinary experts.

The Applied Physics track is designed for students who have an interest in the experimental and quantitative aspects of physics. This track provides a solid preparation for almost any technical career, including engineering, because it teaches students the origin of many approximations in other disciplines. Students are encouraged to explore other STEM fields including education, leading to a minor or possible double-major. Applied Physics majors work within well-supported laboratory spaces and are prepared for in-demand, diverse STEM careers.

## Student Learning Outcomes

1. Students will demonstrate knowledge of fundamental laws of physics.
2. Students will demonstrate mathematical skills, using calculus, vector analysis, vector calculus, matrices, linear algebra and elements of statistics.
3. Students will comprehend theoretical problems and then identify approaches to solving them.
4. Students will think critically to synthesize outcomes of experiments and solutions to problems.
5. Students will have facility with key pieces of equipment for experiments in physics.
6. Students will communicate effectively via speaking and technical writing.
7. Students will have facility with various computer applications for analysis and presentation of technical results.

8. Students will read advanced textbooks and research papers independently.

9. Students will see connections between areas within physics, and between physics and other disciplines (e.g., mathematics, chemistry, etc.).

10. Students will work collaboratively with others on common projects.

## Major Requirements

Code	Title	Credits
Required courses:		
PHYS 105	University Physics, w/Lab	4
PHYS 106	University Physics w/Lab	4
PHYS 190	Physics PEER Journey	1
PHYS 211	Modern Physics	3
PHYS 220	Materials, Fluids, & Thermodynamics	3
PHYS 283	Electronics w/Lab	4
PHYS 290	Methods of Mathematical Physics	3
PHYS 300	Optics w/Lab	4
PHYS 482	Physics Seminar	2
<b>Physics elective: Choose 3-4 credits</b>		<b>3-4</b>
PHYS 310	Nuclear & Particle Physics	
PHYS 319	Astrophysics	
PHYS 384	Advanced Physics Laboratory	
PHYS 471	Selected Topics in Physics	
<b>Physics Theory Core: Choose 4 credits</b>		<b>4</b>
PHYS 320	Classical Mechanics w/Lab	
PHYS 360	Statistical Mechanics w/Lab	
PHYS 400	Electromagnetism w/Lab	
PHYS 410	Quantum Mechanics w/Lab	
<b>Total Credits</b>		<b>35-36</b>

## General Education Requirements

The general education requirements for Bachelor of Arts/Bachelor of Science degrees (<https://catalog.umw.edu/undergraduate/general-education/requirements-bachelor-arts-bachelor-science-degrees/>) apply to all students who are seeking to earn an undergraduate B.A., B.S. or B.S.Ed. degree.

Students seeking a Bachelor of Liberal Studies degree have a separate set of BLS general education requirements (<https://catalog.umw.edu/undergraduate/general-education/requirements-bachelor-liberal-studies-degrees/>).

## Electives

Elective courses are those that are not needed to fulfill a general education requirement or major program requirement but are chosen by the student to complete the 120 credits required for graduation with a B.A./B.S./B.S.Ed. degree or the BLS degree. These courses may be taken graded or pass/fail (or S/U in the case of physical education and 100-level dance). No student in a regular B.A./B.S./B.S.Ed. program may count more than 60 credits in a single discipline toward the 120 credits required for graduation.

**Total Credits Required for the Degree:** 120 credits

Plan of Study

This suggested plan of study should serve as a guide to assist students when planning their course selections. It is not a substitute for a student's Degree Evaluation or the Program Requirements listed for this major in the catalog. Academic planning is the student's responsibility, and course selections should be finalized only after speaking with an advisor. Students should familiarize themselves with the catalog in effect at the time they matriculated at the University of Mary Washington. Students should also familiarize themselves with general education requirements (<https://catalog.umw.edu/undergraduate/general-education/>) which can be fulfilled through general electives as well as major/minor course requirements. Course requirements and sequencing may vary with AP, IB, CLEP, Cambridge or previous coursework, transfer courses, or other conditions. To be considered full-time, an undergraduate student must be enrolled in 12 or more credits for the semester.

Course	Title	Credits
<b>Freshman</b>		
<b>Fall</b>		
FSEM 100	First-Year Seminar	3
MATH 121	Calculus I	4
PHYS 105	University Physics, w/Lab	4
PHYS 190	Physics PEER Journey	1
General Education Course		3
<b>Credits</b>		<b>15</b>
<b>Spring</b>		
MATH 122	Calculus II	4
PHYS 106	University Physics w/Lab	4
General Education Courses		6
<b>Credits</b>		<b>14</b>
<b>Sophomore</b>		
<b>Fall</b>		
PHYS 211	Modern Physics	3
PHYS 290	Methods of Mathematical Physics	3
General Education Courses		9
<b>Credits</b>		<b>15</b>
<b>Spring</b>		
PHYS 220	Materials, Fluids, & Thermodynamics	3
General Education Courses or Electives		12
<b>Credits</b>		<b>15</b>
<b>Junior</b>		
<b>Fall</b>		
PHYS 283 or PHYS 300	Electronics w/Lab <sup>1</sup> or Optics w/Lab	4
General Education Courses or Electives		12
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
Physics Theory Core <sup>2</sup>		4
General Electives		11
<b>Credits</b>		<b>15</b>
<b>Senior</b>		
<b>Fall</b>		
PHYS 300 or PHYS 283	Optics w/Lab <sup>1</sup> or Electronics w/Lab	4
Physics Elective <sup>3</sup>		3-4
General Electives		9
<b>Credits</b>		<b>16-17</b>
<b>Spring</b>		
PHYS 482	Physics Seminar	2

General Electives	12
<b>Credits</b>	<b>14</b>
<b>Total Credits</b>	<b>120-121</b>

- <sup>1</sup> These courses are offered every other year.
- <sup>2</sup> Physics Theory Core options include PHYS 320 Classical Mechanics w/Lab, PHYS 360 Statistical Mechanics w/Lab, PHYS 400 Electromagnetism w/Lab, and PHYS 410 Quantum Mechanics w/Lab.
- <sup>3</sup> Physics elective options include PHYS 310 Nuclear & Particle Physics, PHYS 319 Astrophysics, PHYS 384 Advanced Physics Laboratory, and PHYS 471 Selected Topics in Physics.

Physics Faculty

K. Nicole Crowder, Chair  
Matthew C. Fleenor, Margaret Duke ('44) Chair in Applied Physics

**Professors**  
Matthew C. Fleenor

**Associate Professors**  
Varun Suresh Makhija

**Assistant Professors**  
Desmond R. Villabla