Physics and Astronomy

Degrees Offered

- Bachelor of Arts
- Bachelor of Science

Students may not earn both a B.A. and a B.S. in Physics.

Nature of Program

There are two degree options for students in physics. The bachelor of science degree is designed for students committed to a career in research. It can be followed by graduate work in physics, chemistry, materials science, optical sciences, astrophysics, engineering, or in other physical sciences such as meteorology, oceanography, etc. Some students instead pursue positions in industry or in a government laboratory immediately after completing the B.S. This degree program provides a comprehensive grounding in the fundamentals of physics and is usually accompanied by participation in one of the active research programs within the department.

The bachelor of arts degree is designed to prepare students for a career that utilizes physics preparation in conjunction with an applied emphasis. By allowing more free elective choices, it prepares a student for a career that combines a science background with subsequent professional training. Typical career paths for this degree program include teaching, medicine, dental school, medical school, patent law, forensics, health physics, environmental engineering, science journalism, government policy, and business management.

The courses in physics provide a mix of theoretical concepts and practical examples. Each course within a degree plan builds upon the knowledge base acquired in previous courses and, together, these courses allow a student to acquire the combination of physical insight and mathematical skill needed for success in today's demanding job markets.

The department also offers introductory survey courses in physics and astronomy that are of interest to a broad range of students in the social sciences, fine arts, humanities, health sciences, and education. These courses use a minimum of mathematics to introduce the principles of physics and they provide many examples from the "real world" of the environment, energy, space, communications, transportation, and medicine.

For the B.S. degree, an Area of Emphasis is required. The Professional Preparation Area of Emphasis is the typical plan of study for graduate study in physics. Recommendations for the other areas of emphasis include:

Applied Physics

Capstone research/senior design project must emphasize an applied physics topic. Students interested in completing this area of emphasis are encouraged to consider these courses as general electives: EE 311 Junior Instrumentation Lab; CPE 310 & CPE 311 Microprocessor Systems and Microprocessor Laboratory.

Space Physics

Capstone research must emphasize a space physics topic. Students completing this area of emphasis are encouraged to consider the following courses as elective choices: PHYS 340 Experimental Space Physics; EE 223 Electrical Circuits & EE 224 Electrical Circuits Laboratory.

Biophysics

Capstone research must emphasize a biophysics topic. Students interested in this area of emphasis are encouraged to consider these courses as electives: BIOL 117 Introductory Physiology; BIOL 219 The Living Cell; PHYS 225 Medical Imaging Physics. Students considering medical school are encouraged to take CHEM 233 Organic Chemistry & CHEM 235 Organic Chemistry Laboratory in place of CHEM 231, and follow with CHEM 234 Organic Chemistry & CHEM 236 Organic Chemistry Laboratory as elective courses.

COMPUTATIONAL PHYSICS

Capstone research must emphasize a computational physics topic. Students interested in this area of emphasis are encouraged to consider these courses as electives: CS 221 Analysis of Algorithms; STAT 215 Introduction to Probability and Statistics.

MATERIALS SCIENCE

Capstone research must emphasize a materials science topic. Students interested in this area of emphasis are encouraged to consider these courses as electives: PHYS 321 Optics; CHEM 233 Organic Chemistry & CHEM 235 Organic Chemistry Laboratory. CHEM 233 & 235 are highly recommended for students interested in studying polymers.

MEDICAL PHYSICS

Capstone research must emphasize a medical physics topic. Students interested in this area of emphasis are encouraged to consider these courses as electives: BIOL 219 The Living Cell; BIOL 310 Advanced Cellular/Molecular Biology. Students considering medical school are encouraged to take CHEM 233 Organic Chemistry & CHEM 235 Organic Chemistry Laboratory in place of CHEM 231, and follow with CHEM 234 Organic Chemistry & CHEM 236 Organic Chemistry Laboratory as elective courses.

Certificate of Global Engagement

Students in the Eberly College, regardless of their major, can earn a Certificate of Global Engagement. Completion of the Certificate demonstrates the student's knowledge of diverse cultures, as well as the ability to communicate and interact effectively with people of different cultural backgrounds. Students will be required to apply their knowledge of contemporary issues and global social contexts to their course work and their broader citizenship. For details regarding Certificate requirements, please visit the Eberly College page (http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/#otherdegreestext).

FACULTY

CHAIR

- Earl Scime - Ph.D. (University of Wisconsin - Madison)
  Oleg D. Jefimenko Professor, Plasma Physics

PROFESSORS

- Wathiq Abdul-Razzaq - Ph.D. (University of Illinois - Chicago)
  Physics Education
- Leonardo Golubovic - Ph.D. (University of Belgrade)
  Theoretical Condensed Matter Physics and Statistical Physics
- Matthew Johnson - Ph.D. (California Institute of Technology)
  Experimental Condensed Matter Physics
- Mark E. Koepke - Ph.D. (University of Maryland)
  Plasma Physics, Experiment
- James P. Lewis - Ph.D. (Arizona State University)
  Computational Condensed Matter Physics
- Lian Li - Ph.D. (University of Arizona)
  Carroll Professor, Experimental Condensed Matter Physics
- Duncan R. Lorimer - Ph.D. (University of Manchester)
  Astrophysics/Astronomy
- Maura McLaughlin - Ph.D. (Cornell University)
  Eberly Family Professor, Astrophysics/Astronomy
- Sheena Murphy - Ph.D.(Cornell University)
  Experimental Condensed Matter Physics
- Earl E. Scime - Ph.D. (University of Wisconsin - Madison)
  Oleg D. Jefimenko Professor, Plasma Physics
- Gay Stewart - Ph.D. (University of Illinois-Urbana Champaign)
  Eberly Professor of SEM Education

ASSOCIATE PROFESSORS

- Loren Anderson - Ph.D. (Boston University)
  Astrophysics/Astronomy
- Alan Bristow - Ph.D. (University of Sheffield)
  Experimental Condensed Matter Physics
- Paul Cassak - Ph.D. (University of Maryland)
  Plasma Physics, Theory
- Mikel Holcomb - Ph.D. (University of California - Berkeley)
  Condensed Matter Physics

- Paul Miller - Ph.D. (West Virginia University)
  Physics Education Research
- D.J. Pisano - Ph.D. (University of Wisconsin - Madison)
  Astrophysics/Astronomy
- Aldo Romero - Ph.D. (University of California - San Diego)
  Theoretical Condensed Matter Physics
- Tudor Stanescu - Ph.D. (University of Illinois)
  Theoretical Condensed Matter Physics
- John Stewart - Ph.D. (University of Illinois-Urbana Champaign)
  Physics Education Research

ASSISTANT PROFESSORS

- Sarah Burke Spolaor - Ph.D. (Swinburne University of Technology)
  Astrophysics/Astronomy
- Cheng Cen - Ph.D. (University of Pittsburgh)
  Condensed Matter Physics
- Edward Flagg - Ph.D. (University of Texas - Austin)
  Condensed Matter Physics
- Mikel Holcomb - Ph.D. (University of California - Berkeley)
  Experimental Condensed Matter Physics
- Sean McWilliams - Ph.D. (University of Maryland)
  Astrophysics/Astronomy
- Kathryn Williamson - Ph.D. (Montana State University)
  Astronomy Education Research
- Weichao Tu - Ph.D. (University of Colorado - Boulder)
  Space Plasma Physics

RESEARCH PROFESSORS

- Vladimir Demidov - Ph.D. (St. Petersburg University)
  Plasma Physics and Plasma Chemistry

RESEARCH ASSOCIATE PROFESSORS

- Amy Keesee - Ph.D. (West Virginia University)
  Plasma Physics

RESEARCH ASSISTANT PROFESSOR

- Julian Schulze - Ph.D. (Ruhr University - Bochum)
  Plasma Physics
- Qiang Wang - Ph.D. (University of Colorado - Boulder)
  Condensed Matter Physics

PROFESSORS EMERITI

- Larry E. Halliburton - Ph.D. (University of Missouri - Columbia)
  Condensed Matter Physics
- Arthur S. Pavlovic - Ph.D. (Columbia University)
  Condensed Matter Physics
- Mohindar S. Seehra - Ph.D. (University of Rochester)
  Eberly Family Professor, Condensed Matter Physics
- Richard Treat - Ph.D. (University of California – Riverside)
  General Relativity)
- H. Arthur Weldon - Ph.D. (Massachusetts Institute of Technology)
  Particle Physics

Admission Requirements

Honor students and students who qualify to take college Algebra (MATH 126) or above, after taking the ALEKS Assessment (http://math.wvu.edu/placement), are admitted directly into the B.A. or B.S. physics program. Students transferring from another major must meet milestones set by the department: a GPA of 2.2 in math & physics courses with at least one math & physics course completed and a 2.0 overall GPA. Please see a departmental adviser for details.

Benchmark Expectations

Students must have a cumulative GPA in the major requirements of 2.2 or better after completing two physics courses, or they will be placed on probation.

- Students who do not raise their GPA in the major requirements above 2.2 after one semester on probation will be removed from the Major.
- Students may repeat any physics or mathematics course for which the grade is a D/F/W. If a course is repeated, the GPA will be calculated according to the WVU repeat policy.
- Students not able to attain better than a D/F/W by the second attempt in a mathematics or physics course will be placed on probation.
- A student with three grades of D/F/W in the same physics or mathematics course will be removed from the Major.

Major Learning Goals

PHYSICS

Upon successful completion of the B.S. degree, **Physics** majors will demonstrate:

1. An understanding of and ability to solve basic conceptual and quantitative problems in theoretical mechanics, electricity and magnetism, quantum mechanics, and thermodynamics.
2. An ability to perform accurate measurements of physical systems and communicate the results and implications of those measurements orally and in writing.
3. An ability to develop experiments to test basic or applied research questions, to perform accurate experimental measurements, and to critically evaluate others' answers to research questions.
4. Preparation for success in graduate school or in a post baccalaureate career.

Upon successful completion of the B.A. degree, **Physics** majors will demonstrate:

1. An understanding of and ability to solve basic conceptual and quantitative problems in foundational physics areas and to apply complex reasoning and problem solving skills developed in physics across disciplines, with focus on such application in a cognate area.
2. An ability to perform accurate measurements of physical systems and communicate the results and implications of those measurements orally and in writing.
3. An ability to develop experiments to test basic or applied research questions, to perform accurate experimental measurements, and to critically evaluate others' answers to research questions.
4. Preparation for success in a post baccalaureate career, or graduate or professional school in the cognate area.

The Physics B.A. is designed to prepare students for a career that utilizes physics preparation in conjunction with an applied emphasis. Some common examples are teaching, science journalism, medicine or patent law. Students work with their advisors to choose complementary courses tailored to suit the student's career aspirations. These hours are completed within the block of elective hours.

ASTRONOMY MINOR

MINOR CODE - U087

Physics majors may complete an astronomy minor, provided the ASTR courses counted toward the minor are not counted as electives toward the physics major. A minimum grade of C or better is required in each course counted toward the minor.

Students must earn a minimum overall GPA of 2.00 in all courses applied to the minor.

Core Courses:		
PHYS 111	General Physics	4
PHYS 112	General Physics	4
PHYS 314	Introductory Modern Physics	4
Upper Division Electives: *		9
Select three electives from any ASTR courses numbered 300 and above.		
Total Hours		21

* An ASTR course applied toward an ASTR minor may not be counted toward a PHYS minor.

PHYSICS MINOR

MINOR CODE - U026

A grade of C- or better is required in each course counted toward the minor:

Core Courses:		
PHYS 111	General Physics	4
PHYS 112	General Physics	4
PHYS 314	Introductory Modern Physics	4
General Electives:		6
One PHYS course at the 300-level or above		
One PHYS or ASTR course at the 300-level or above *		
Total Hours		18

* An ASTR course applied toward an ASTR minor may not be counted toward a PHYS minor.