

# PHYSICS (PHY) COURSES

Some special topics courses listed below may have individual offerings that will apply to distribution requirements. See the Curriculum Outline (<http://bulletin.wabash.edu/curriculum/curriculum-outline/>) section of this Bulletin for more information.

## PHY-101 Astronomy

An introductory course intended for the non-science liberal arts student. Historical and philosophical ideas will be stressed as well as the experimental concepts and methods used in astronomy. A good working knowledge of algebra, plane geometry, and trigonometry is required. Satisfies half of the laboratory science requirement. Three class periods and one laboratory each week.

**Prerequisites:** none

**Credit:** 1

**Distribution:** Science Lab, Quantitative Literacy

## PHY-104 Special Topics

A special interest course for the non-science liberal arts student on an introductory-level physics topic not covered in a regular physics course. (Does not count toward the major or minor, or the lab science requirement.) Topics vary with each scheduled offering. Refer to Student Planning's section information for descriptions of individual offerings, and applicability to distribution requirements.

**Prerequisites:** none

**Credits:** 0.5-1

## PHY-105 Adventures in Physics

A one-semester course for the non-science liberal arts student that investigates the world from the viewpoint of a physicist. Topics will vary and will be announced prior to registration. Partially fulfills the college laboratory science requirement, but does not count toward a physics major or minor. Three class periods and one laboratory each week.

**Prerequisites:** none

**Credit:** 1

## PHY-109 Physics I - Algebra

An introduction to the study of motion and waves; topics include Newton's laws, energy and work, periodic motion and feedback, sound and light waves, and optics. These topics are especially relevant for students interested in pre-health. The lab activities will introduce measurement techniques and will emphasize understanding the limits to any measurement. Three class periods and one lab period each week. Partially fulfills the college laboratory science requirement, and may count toward a physics major or minor with department permission. This course is typically offered in the fall semester. Not available to students who have received credit for PHY-111. Also not available to students who have taken or been placed in MAT-112 without instructor permission.

**Prerequisites:** none

**Credit:** 1

**Distribution:** Science Lab, Quantitative Literacy

## PHY-110 Physics II - Algebra

An algebra-based introduction to electricity and magnetism for general audiences, including the social and life sciences. Topics include Coulombs law, electric circuits, magnetic fields, electromagnetic induction, and geometric optics. The lab will introduce data acquisition and analysis techniques. Three class periods and one laboratory each week. Not available to students who have taken PHY-111 without Instructor permission.

**Prerequisites:** PHY-109 or PHY-111, or approval of instructor

**Credit:** 1

**Distribution:** Science Lab, Quantitative Literacy

## PHY-111 Physics I - Calculus

A calculus-based introduction to classical mechanics for physics, chemistry, and engineering. Topics include Newton's laws of motion, conservation laws, and rotational dynamics. The lab will introduce data acquisition and analysis techniques. Three class periods and one laboratory each week.

**Prerequisites:** MAT-111 or placement into MAT-111 with concurrent registration, or placement into MAT-112 or MAT-223

**Credit:** 1

**Distribution:** Science Lab, Quantitative Literacy

## PHY-112 Physics II - Calculus

An introduction to the fundamental concepts concerning fluids, waves, optics, electricity, and magnetism. Three class periods and one laboratory each week. This course is offered in the spring semester.

**Prerequisites:** PHY-111 with a minimum grade of C-

**Credit:** 1

**Distribution:** Science Lab, Quantitative Literacy

## PHY-177 Special Topics

This course is offered in the fall semester. Topics vary with each scheduled offering. Refer to Student Planning's section information for descriptions of individual offerings, and applicability to distribution requirements.

**Prerequisites:** none

**Credits:** 0.5-1

## PHY-178 Special Topics

This course is offered in the spring semester. Topics vary with each scheduled offering. Refer to Student Planning's section information for descriptions of individual offerings, and applicability to distribution requirements.

**Prerequisites:** none

**Credits:** 0.5-1

## PHY-187 Independent Study

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1

## PHY-188 Independent Study

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1

## PHY-209 Intro Thermal Phy & Relativity

An introduction to thermal physics and special relativity. Topics include the laws of thermodynamics, statistical nature of entropy, Lorentz transformations, equivalence of mass and energy. The lab will introduce the methodology of experimental design, numerical techniques for solving differential equations, and the writing of scientific papers using LaTeX software. Three class periods and one laboratory each week. This course is offered in the fall semester.

**Prerequisites:** PHY-112 with a minimum grade of C-, and MAT-112

**Credit:** 1

**Distribution:** Quantitative Literacy, Science Lab

**PHY-210 Intro Quantum Theory & Apps**

An introduction to quantum theory with applications to atomic, solid state, nuclear, and particle physics. Three class periods and one laboratory each week. This course is offered in the spring semester.

**Prerequisites:** PHY-209 with a minimum grade of C-, and MAT-223

**Credit:** 1

**Distribution:** Science Lab, Quantitative Literacy

**Equated Courses:** CR

**PHY-220 Electronics**

Introduction to analog and digital electronics. Fundamentals of DC and AC circuits, transistors, and amplifiers will be covered. Includes one laboratory each week.

**Prerequisites:** PHY-112 with a minimum grade of C-

**Credit:** 1

**Distribution:** Science Lab, Quantitative Literacy

**PHY-230 Thermal and Statistical Physics**

Introduction to thermal and statistical physics. The laws of thermodynamics are studied from microscopic and macroscopic perspectives. Quantum statistical mechanics will be developed and applied to blackbody radiation, fermionic and bosonic systems.

**Prerequisites:** PHY-210 with a minimum grade of C-

**Credit:** 1

**Distribution:** Quantitative Literacy

**PHY-235 Stochastic Simulation**

Interesting real world phenomena often involve randomness at some level, and this course develops mathematical and computational tools for studying these systems. In particular, students will study and implement computer simulation models of continuous and discrete stochastic processes with potential applications in physics, economics, epidemiology, networks, sports, elections, and industrial engineering. Specific topics for study include: basic probability models, pseudo-random number generation, queueing models, discrete event simulations, Poisson processes, random walks, Markov chains, Monte Carlo methods, and statistical analysis of simulated data.

**Prerequisites:** MAT-112 and CSC-111

**Credit:** 1

**PHY-277 Special Topics**

Topics vary with each scheduled offering. Refer to Student Planning's section information for descriptions of individual offerings, and applicability to distribution requirements.

**Prerequisites:** none

**Credits:** 0.5-1

**PHY-278 Special Topics**

This course is offered in the spring semester. Topics vary with each scheduled offering. Refer to Student Planning's section information for descriptions of individual offerings, and applicability to distribution requirements.

**Prerequisites:** none

**Credits:** 0.5-1

**PHY-287 Independent Study**

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1

**PHY-288 Independent Study**

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1

**PHY-302 Electron Microscopy**

Electron microscopes employ a focused beam of highly energetic electrons to examine sample morphology and topography on a very fine scale. This information is essential to the characterization of a wide range of biological and inorganic specimens including microorganisms, cells, crystals, metals, microelectronics, and nanomaterials. The initial classroom portion of this course focuses on fundamental topics in instrument design, applications, limitations, and sample preparation methods. Subsequent laboratory work involves hands-on instrument training and a substantial microscopy project.

**Prerequisites:** none

**Credit:** 1

**Equated Courses:** CHE-302

**PHY-310 Classical Mechanics**

Advanced topics in classical mechanics, including harmonic motion and Lagrangian mechanics.

**Prerequisites:** PHY-112 with a minimum grade of C- and MAT-224, or permission of instructor

**Credit:** 1

**PHY-314 Electromagnetic Theory**

Advanced explorations in understanding and applying Maxwell's equations. This course is offered in the spring semester.

**Prerequisites:** PHY-112 with a minimum grade of C-, MAT-224, and MAT-225

**Credit:** 1

**Distribution:** Quantitative Literacy

**PHY-315 Quantum Mechanics**

Introduction to quantum mechanics. Topics include Dirac notation, postulates of quantum mechanics, and applications to important physical systems. This course is offered in the fall semester.

**Prerequisites:** PHY-210 with a minimum grade of C-, MAT-223, and MAT-224

**Credit:** 1

**Distribution:** Quantitative Literacy

**PHY-377 Adv Special Topics in Physics**

Special interest course covering one of a selection of advanced physics topics including: atomic physics, nuclear physics, quantum field theory, advanced electrodynamics, advanced quantum mechanics, advanced classical mechanics, or other topics proposed by students. Topics vary with each scheduled offering. Refer to Student Planning's section information for descriptions of individual offerings, and applicability to distribution requirements.

**Prerequisites:** PHY-210

**Credits:** 0.5-1

**PHY-378 Adv. Special Topics in Physics**

Special interest course covering one of a selection of advanced physics topics including: atomic physics, nuclear physics, quantum field theory, advanced electrodynamics, advanced quantum mechanics, advanced classical mechanics, or other topics proposed by students. This course is offered in the spring semester. Topics vary with each scheduled offering. Refer to Student Planning's section information for descriptions of individual offerings, and applicability to distribution requirements.

**Prerequisites:** PHY-210

**Credits:** 0.5-1

**PHY-381 Advanced Laboratory I**

Students will participate in a broad range of experiments that cover major research areas in contemporary physics, including atomic, molecular, and optical physics, condensed matter physics, and nuclear and particle physics. Advanced measurement and data analysis techniques will be used. All experiments will be planned, executed, and presented according to current professional standards. Students should take this course during their junior year.

**Prerequisites:** PHY-210

**Credits:** 0.5

**PHY-382 Advanced Laboratory II**

This course is an independent research project, typically a continuation of either an Advanced Laboratory I project or a summer internship research project. Typically taken in the fall semester of the senior year.

**Prerequisites:** PHY-381

**Credits:** 0.5

**PHY-387 Independent Study**

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1

**PHY-388 Independent Study**

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1

**PHY-400 Senior Seminar**

This course is a senior seminar course which all physics majors should take in their final year at Wabash. Course work will include reading primary literature, designing research projects to address societal issues, exploring the demographics and diversity of scientists, proposing outreach methods to make physics more inclusive, and evaluating the moral and ethical responsibilities of science. This course is offered in the fall semester

**Prerequisites:** PHY-210

**Credits:** 0.5

**Distribution:** Global Citizenship, Justice, and Diversity

**PHY-487 Independent Study**

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1

**PHY-488 Independent Study**

Individual research projects. The manner of study will be determined by the student in consultation with the instructor. Students must receive written approval of their project proposal from a department Chair before registering for the course.

**Prerequisites:** none

**Credits:** 0.5-1