

Physics

Physicists are concerned with an extremely broad range of natural phenomena, extending from the submicroscopic world of elementary particles to the vast reaches of the cosmos and the origins of the universe, from the simplest of everyday activities to the behavior of matter at the furthest extremes in energy, temperature, distance, and time. The defining characteristic of physics is the quest for the underlying logic—the theoretical structure that unifies and explains all the different phenomena that we study experimentally. Both the experiments themselves and the theoretical work that goes on at the same time are motivated primarily by this quest. As a by-product of this quest, physicists have pioneered many of the basic ideas on which our modern technology rests. Such developments as transistors, lasers, and perhaps someday fusion energy all come directly from research in physics.

Pursuing Physics at Ohio State

The most important preparation for a major in physics is strong high school science and math. Students should have had some calculus, or be prepared to begin calculus upon arrival at Ohio State, in order to begin the physics program without unnecessary delay.

The Department of Physics wants to become involved with students as soon as they know that they intend to become physics majors, which can be as early as their first arrival at Ohio State. Those who intend to major in physics or are interested in exploring that option should contact the Undergraduate Studies Office in the Department of Physics and talk to the vice chair for Undergraduate Studies. Call (614) 292-8523 for an appointment.

Students who come to Ohio State majoring in physics enroll in the College of the Arts and Sciences (ASC). A major in engineering physics is also available in the College of Engineering. Further information on engineering physics is available in the major series, online at majors.osu.edu.

Program Educational Objectives

- Provide students with the opportunity to master the fundamental areas of physics: classical mechanics, electromagnetism, quantum mechanics, and thermodynamics
- Allow students to develop problem-solving skills and the ability to analyze physical systems and to understand the theoretical framework which applies to them
- Provide students with a basic mastery of experimental science, including an understanding of data reduction and error analysis
- Teach students to communicate effectively both orally and in writing
- Provide students with the opportunity to develop a basic knowledge of and facility with computing

Physics Requirements

A student who is interested in majoring in physics should consider carefully whether to choose a program in the College of the Arts and Sciences (Bachelor of Science in Physics) or in the College of Engineering (Bachelor of Science in Engineering Physics). The courses of study are very similar and prepare students for a variety of outcomes including graduate school in physics, astronomy, math, or engineering; professional school; and employment as engineers, programmers, teachers, technicians, and scientists. Students interested in finding more information on the Engineering Physics major can visit www-afa.adm.ohio-state.edu/u-majors/pdf/engiphy.pdf.

Students pursuing a BS in physics can choose from among six options ranging from a rigorous preparation for graduate study in physics to a more flexible option for students who wish to combine a core of physics courses with courses in other areas. In addition to the technical electives unique to each option, all physics majors must also complete the core physics and math requirements. Students choose one of the following options based on what they want to do after they finish their undergraduate work:

- Advanced Physics (option A): designed for students who wish to pursue an advanced physics degree; this option provides an excellent preparation for graduate school in physics
- Physical, Mathematical, and Engineering Science (option B): designed for physics majors who have a strong interest in some other area of science, engineering, or math
- Biophysics & Biomedical Physics (option C): designed for students who have an interest in biophysics or biomedical physics and wish to pursue employment or an advanced degree in those areas
- Pre-Medical (option D): designed for those intending to attend medical school; this option satisfies all of the medical school admission requirements when combined with the required physics and math courses in the physics core curriculum.
- Secondary Education (option E): created for those seeking secondary level certification in physics (i.e., to be a high school teacher); this option has been designed to satisfy the College of Education Master of Education (physics certification) curriculum
- Personalized Program (option F): for students with special interests not covered in options A through E

Co-Curricular Opportunities

The Department of Physics encourages all of its students to become involved in research with a faculty member on one of many active research programs. This is an excellent opportunity to learn about and become involved in cutting edge physics research and discoveries. Areas of research include astrophysics, nuclear and elementary particle physics, string theory, solid state physics, superconductivity, and low temperature physics. In addition, undergraduate physics student organizations have many activities, including hosting guest physicists who speak about their research.

For more information, check these web sites:

Physics: physics.ohio-state.edu/undergrad
College of Mathematical & Physical Sciences:
mps.osu.edu

Ohio State: osu.edu
Admissions: undergrad.osu.edu
Multicultural Center: multiculturalcenter.osu.edu

Curriculum Sample *

This is a sample list of classes that a student will take to pursue a Bachelor of Science in Physics. Since university students need more than specific education in a narrow field, they also will take classes to complete the General Education Curriculum (GEC). The GEC will allow students to develop the fundamental skills essential to collegiate success across major programs. Course work options satisfying the GEC often come from a variety of academic areas of study allowing students to tailor their GEC toward their interests. Note: This sample curriculum represents courses a student would take for Option A: Advanced Physics, which is one of several possible paths to a degree in Physics at Ohio State. Consult the Department of Physics Undergraduate web site, physics.ohio-state.edu/undergrad for details on each specific option.

Freshmen Year:

MPS survey	1
Calculus & Analytic Geometry I, II, III	15
Introductory Physics* I, II, III	15
Computer Programming	4
GEC (English composition)	5
GEC (foreign language)	10
Total hours	50

Sophomore Year:

Calculus & Analytic Geometry IV	5
Differential Equations	4
Vector Analysis	3
Dynamics of Particles & Waves I, II, II	12
Physics Seminar	1
Data Analysis Physics Lab	4
GEC (foreign language)	10
GEC (2nd writing course)	5
Total hours	44

Junior Year:

Linear Algebra	3
Introductory Electronics Lab	4
Fields & Waves I, II, III	12
Quantum Mechanics I, II, III	12
GEC (historical study)	10
GEC (biological science)	5
Total hours	46

Senior Year:

Senior Writing Course (Physics)	3
Statistical Physics I, II	8
Theoretical Mechanics	4
Advanced Physics Lab	4
GEC (social sciences)	10
GEC (arts & humanities)	10
GEC (breadth course)	5
Total hours	44

* Well-qualified students are encouraged to start the honors version of the introductory physics sequence autumn quarter of their first year.

Honors & Scholars Programs

The department supports an active honors program, starting with the honors sequence Physics H131, H132, H133, which must be started in the autumn quarter and is recommended for well-qualified entering freshmen. The honors program culminates in research experience in a faculty member's area of specialization.

Honors & Scholars programs represent great opportunities to be part of a smaller community within a large university. Good candidates for these programs will receive additional information upon admission to the university. Learn more about the Honors & Scholars program at honors-scholars.osu.edu.

Career Prospects in Physics

In today's fast-changing society, physicists may play a number of important roles—sometimes simultaneously. As workers in basic research, physicists may help expand the frontiers of the knowledge of the physical universe; as teachers in high schools, colleges, or universities, they may help to transmit to others knowledge and appreciation of that universe and of scientific methods of investigating and understanding it. In an industrial laboratory or government agency, physicists may deal with the application of fundamental knowledge to the development of solutions for a wide range of practical problems, or they may be managers of large scientific or technical programs. In collaboration with colleagues in other disciplines, physicists may help attack problems spanning a number of important areas, many of which—such as energy usage, radiation hazards, and environmental issues—are of current public concern.

Recent graduates in physics have been employed at salaries in the range of \$40,000 to \$55,000.

More About Physics

The Department of Physics distinctions

Distinguished faculty and staff:

- OSU Alumni Award for Distinguished Teaching (1997, 1999, 2000, 2001, 2003, 2004, 2005, 2007, 2008, 2009)
- OSU Distinguished Undergraduate Research Mentor Award (2007, 2008)
- many National Science Foundation Young investigator awards, Sloan Research Fellows, American Association for the Advancement of Science (AAAS) Fellows, and American Physical Society (APS) Fellows
- Distinguished Scholar Award (2007)
- Faculty Award for Distinguished Service (2008)
- OSU Distinguished Staff Award (2009)

Distinguished students:

- 12 Goldwater Scholarship recipients in the past 10 years
- 11 National Science Foundation (NSF) Fellowship recipients in the past 10 years
- 2007 Rhodes Scholar
- Two 2009 Gates-Cambridge Scholarship Finalists
- 1st, 2nd, 3rd, and 4th place winners of the Denman Research Forum

Recent graduates of the physics program have gone on to study physics, engineering, and astronomy at top universities such as Harvard University, Stanford University, University of Pennsylvania, University of Oxford, University of Hawaii, and University of Chicago.

Revised July 2009. For the most up-to-date information on the physics program, please visit physics.ohio-state.edu/undergrad.

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