

## THE FIELD

Physics is the basic science that underlies all of the physical sciences and influences most biological and materials sciences. It treats matter, energy, and interactions at the fundamental level. Subdisciplines include acoustics, optics, mechanics, thermodynamics, atomic, nuclear, condensed-matter, low-temperature, elementary-particle, plasma, astrophysics, biophysics, geophysics, soft-matter physics, relativity, and nonlinear dynamics. Physics is a laboratory-based science in which experiments reveal observable properties of the natural world and theories provide an understanding of the observations as well as the capacity to predict.

A physicist's work can be classified as basic (fundamental) or applied. The scientist doing basic research typically works in a university or national laboratory and is interested in the fundamental processes of nature. The applied physicist wants to develop knowledge for technological advances and may be found more often in an industrial setting (but there are certainly exceptions to both of these statements). In addition, physicists usually choose to be either experimentalists or theorists. The experimenter uses apparatuses to test theories and to explore new phenomena or develop new applications of ideas. The theorist uses that data to develop new explanations, hypotheses, or theories. Physicists also use computers to simulate a physical system, gaining new insights into real systems.

***A minor in physics is available.***

## THE MAJOR

The Department of Physics offers a variety of options at all academic levels. The three available tracks—professional (BS), applied (BS), and general (BA)—enable students to tailor the major to suit their goals. Students desiring a broad background in physics and/or intending to go to graduate school in physics or closely related fields should follow the professional track. Students with a particular interest in a topic outside the standard realm of physics may choose the applied track. The applied track replaces some of the junior- and senior-level physics courses with courses from other departments, chosen according to a concentration area developed with an advisor. The general track (BA) is well suited to students who wish to obtain jobs in non-technical areas after graduation, such as K–12 teaching, law school, or public policy. This track replaces some junior- and senior-level physics courses with courses in a chosen concentration in a nontechnical area, such as finance, teaching, or science writing. For those interested in K–12 teaching, this track can be followed to earn credits toward teacher certification. Visit [umass.edu/education](http://umass.edu/education) for more information.

All major courses (both lectures and labs) are taught by faculty. The student-faculty ratio makes it easy for students to interact directly with professors and get extra help and advice. Moreover, each physics major has an academic advisor who is a professor, and who usually advises the student throughout the full four-year program. Physics faculty members (approximately 30 professors) are engaged in cutting-edge research in the following areas: condensed-matter physics, elementary-particle physics, nuclear physics, biological physics, polymer physics, low-temperature physics, soft-matter physics, and nonlinear dynamics. There are excellent facilities supported by several million dollars annually in external research funds. This activity makes it possible to bring the frontiers of physics to the classroom. This activity also encourages students to participate in original research through independent study, the departmental honors program, or work-study. Many students also work full time in research during the summer. This work experience is outstanding training for future jobs in research or for application to graduate school. Faculty members are proud of the fact that a majority of students engage in research while at UMass. Whatever their future path, this experience provides valuable skills and insights, as well as being very interesting and engaging.

## HONORS

Please contact the departmental honors program director for information about honors opportunities within the major. Departmental honors in physics involves a senior thesis (capstone—an excellent training in research) and supplementary honors courses.

## STUDY ABROAD

Majors may choose to study abroad if it supports their academic and career goals. Students should first contact the International Programs Office (413-545-2710, [umass.edu/ipo](http://umass.edu/ipo)) and work with their academic advisor.

## CAREER OPPORTUNITIES

Physics provides a broad background of fundamental principles and advanced problem-solving and critical analysis skills for a wide variety of careers in science and technological fields. Graduates include a chemical engineer, a supervisor in charge of inspection techniques for nuclear power plants, a systems engineer in ship design, an oceanographer, and a physics professor at UMass Amherst. Students who pursue a lab-oriented or computational curriculum are well prepared for work in academic or industrial research and development. The major is also good preparation for those planning to pursue a secondary school teaching license. The necessary education courses can easily fit into a physics program, especially the general track (BA). For teaching at the community college level, a master's degree is usually the minimum requirement. At the college or university level and for many research jobs in government or industrial laboratories, a PhD is required. UMass Amherst has a flourishing PhD program.

The program includes curricular and extracurricular activities to help students learn about career options and decide where their path lies. In their first semester, students are encouraged to enroll in a 1-credit course that gives an overview of our research and selected professional development skills. Later, students are encouraged to take another 1-credit course on professional development, including tactics for identifying career paths and finding jobs and internships. Throughout the academic year, visitors are invited to campus who have a BS in physics as part of our "Physicists-in-Industry" series. These visitors give public presentations about their work and their path, and they also meet with students in small groups.

Many physics students also take courses in other sciences, in mathematics (which is required), or in engineering. These courses strengthen industrial marketability or prepare students for graduate school in programs such as astronomy, biophysics, meteorology, geophysics, oceanography, computer science, and polymer science. Others major in physics in order to prepare for medical, dental, or law school. Physics students can also join the UMass Integrated Concentration in Science (iCons) program, which provides excellent training in problem solving, leadership, and innovation in science and technology. For information on iCons, visit [icons.cns.umass.edu](http://icons.cns.umass.edu).

## COLLEGE OF NATURAL SCIENCES

The College of Natural Sciences unites the life, environmental, computational, and physical sciences on campus. Students take advantage of a range of inquiry-based classroom and laboratory experiences, hands-on undergraduate research opportunities, multidisciplinary and cross-departmental education and research initiatives, and a variety of science student organizations. In addition, they are encouraged to develop strong written and oral communication skills, as well as leadership and problem-solving abilities.

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