

# College of Arts and Science

## Department of Physics & Astronomy

Physics is the science most responsible for engines, electricity, space travel, laser surgery, nuclear energy, computers, bullet trains, 100-story buildings and magnetic resonance imaging (MRI). Working side by side with professors in the lab, MU physics majors can play a role in 21st-century scientific breakthroughs. They get to do physics, not just read about it.

### Our Strengths

Physics is the most basic of all sciences. Its goal is to understand and explain the natural world through a concise set of universal laws and fundamental principles, expressed in the language of mathematics. With a scope of subject matter ranging from the interior of elementary particles to the galaxies at the edge of the universe, the study of physics offers the curious mind an exciting and unique appreciation of our world.

Undergraduate physics students at MU have access to a wide variety of educational facilities, laboratories and research opportunities. Well-equipped teaching laboratories provide students with hands-on experience to supplement classroom activities, while individual experimentation and open-ended projects are encouraged for junior and senior students. Computer laboratories located in the physics building provide ready access to sophisticated equipment for projects related to research and classroom work. Most important, this is a research-active department. Our faculty members frequently invite undergraduates to join them in their laboratories to work on fundamental problems in research areas such as holographic imaging of tumors, formation of galaxies, phase transitions in condensed matter, folding of proteins, colossal magneto-resistance, spintronics, etc.

### Personal Attention

The department's faculty members quickly get to know students through class work and research. Homework assignments in advanced courses are often discussed on a one-on-one basis. Laboratory courses involve small groups working together with the instructor. Also faculty and students interact at physics club meet-

ings and career seminars. The numerous students working in faculty research labs consider their faculty mentors colleagues and friends.

### Majoring in Physics

The Department of Physics offers two undergraduate degree programs: the bachelor of arts (BA) in physics and the bachelor of science (BS) in physics. The BA degree provides a broad coverage of classical and modern physics while permitting a broader liberal arts education. It is normally selected by students who do not envision a professional career in physics but who plan to enter a professional school later in their academic career, e.g., medicine, dentistry, law or who desire to pursue a teaching certificate. The BS degree in physics is designed to prepare students for scientific careers immediately upon graduation or for further training in graduate school.

Candidates for either degree must complete a minimum of 120 credit hours with an average grade of C or better. For the BA degree, students must complete 31 credit hours in physics and 22 credit hours in math, chemistry and computer science. For the BS degree, students must complete 40 credit hours in physics and 28 credit hours in math, chemistry and computer science. A student completing the BS degree automatically receives a minor in math. Both degrees allow students to specialize in such areas as astronomy, biological physics, medical physics or engineering physics.

### Degree Requirements

The following is a typical study program leading to the BS degree in physics, with credit hours as indicated.

### Freshman Year

#### FIRST SEMESTER

*Calculus I* (5)

*Undergraduate Physics Seminar* (2)

*General Chemistry II* (3)

*General education, foundation or electives* (3)

#### SECOND SEMESTER

*Calculus II* (5)

*University Physics I* (5)

*General education, foundation or electives* (3)

### Sophomore Year

#### FIRST SEMESTER

*Calculus II* (3)

*University Physics II* (5)

*General education, foundation or electives* (6)

#### SECOND SEMESTER

*Introduction to Modern Physics (writing intensive)* (3)

*Differential Equations* (3)

*Classical Mechanics* (3)

*General education, foundation or electives* (3-6)

### Junior Year

#### FIRST SEMESTER

*Methods for Mathematical Physics* (3)

*Applied Analysis* (3)

*Advanced Physics Lab* (3)

*General education, foundation or electives* (3-6)

#### SECOND SEMESTER

*Intro to Thermodynamics* (3)

*General education, foundation or electives* (3-6)

*Physics elective/research* (3-6)

*Math elective* (3)

*Electricity and Magnetism I* (3)

## Senior Year

### FIRST SEMESTER

*Introduction to Quantum Mechanics* (3)

*Physics elective* (3)

*Physics research* (3)

*General education, foundation or electives*  
(3-6)

### SECOND SEMESTER

*Issues in Modern Physics and Technology*  
(capstone) (3)

*Introduction to Quantum Mechanics II* (3)

*Physics research* (3)

*General education, foundation or electives*  
(3-6)

## Advising

Academic advising for undergraduates is provided by the department's director of undergraduate studies, a faculty member knowledgeable in all aspects of undergraduate advising including transfers, dual majors, honors programs and university regulations. All faculty members are actively involved in helping students make decisions about career opportunities, special programs of study and graduate schools. Presentations by visiting scientists help students appreciate the variety of professional careers available to physicists, and our alumni return regularly to host career seminars.

## Internships

Undergraduate students are strongly encouraged to become involved in a faculty research program. This involvement can be through special problems courses, through part-time employment provided by the faculty member or through internship programs such as those funded by the National Science Foundation and the Howard Hughes Medical Institute. Students participate in undergraduate seminars and in special honors programs built on their own particular interests. More than 75 percent of our recent BS recipients participated in a significant undergraduate research project with a faculty member.

## Physics Organizations

The department has a physics club organized as a chapter of the undergraduate physics honor society Sigma Pi Sigma. It meets on a regular basis. Seniors get a free membership to the American Physical Society, which includes a subscription to the society journal, *Physics Today*. Physics club activities include faculty presenta-

tions, group trips to national meetings and visiting speakers, including some Nobel Laureates.

## Value of a Physics Major

Many career opportunities are available to those who study physics. Physics majors often choose to pursue graduate study and an advanced degree — a necessary requirement for a university position in teaching and research. A list of graduate schools that have accepted our undergraduates in recent years reads like a list of the world's top physics programs; Princeton University, the Massachusetts Institute of Technology and the universities of Wisconsin, Arizona, Illinois, California-Berkeley, Michigan and Virginia, among others. Additional options include scientific research in laboratories associated with industrial organizations or government agencies.

Employment is also available in a number of related technical fields that draw heavily on physics. These include geophysics (oil and gas exploration, earthquakes), health physics, medical physics, atmospheric science and meteorology, data processing and more.

Physics also provides a sound foundation for the study of medicine, law and business, and we have recent graduates in all these areas. The emphasis that physics places on careful analytic thinking and precise mathematical and verbal expression is highly valued in all professions.

## Missouri Admission

The University admits students on the basis of their chances for success here. The main criteria are the high-school curriculum, test scores and class rank.

Applicants are expected to have followed a college-preparatory program with at least 17 units of credit, as follows (one unit equals one year):

### *Four units of English*

Two units emphasizing composition or writing skills are required; one unit may be in speech.

### *Four units of mathematics*

Acceptable courses include algebra I, geometry, algebra II, pre-calculus/trigonometry/analytic geometry, calculus and math analysis. Courses such as computer math, programming, consumer math and accounting are not acceptable.

### *Three units of science*

At least one must be a laboratory course, such as earth science, biology, chemistry

or physics. Courses such as general science and agricultural science are not acceptable.

### *Three units of social studies*

Examples are world history, American government and principles of democracy.

### *Two units in a single foreign language*

### *One unit in fine arts*

If you are interested in applying to the physics program, take advanced mathematics courses and consider subscribing to a science magazine such as *Discover* or *Scientific American*.

## Scholarships

If you apply for financial aid, you will learn about University scholarships and grants for which you may be eligible. In addition, each year the department offers a number of undergraduate scholarships to physics majors who show exceptional aptitude and achievement in their studies. These scholarships, established to honor former teachers and alumni, are also open to incoming freshmen. Typically, the department may offer about 16 scholarships each year, with stipends ranging from \$500 to \$2,000 per year. Students may also hold other scholarship awards.

## How To Apply

For information about applying to the physics and astronomy program, call or write:

Department of Physics and Astronomy

223 Physics Building

University of Missouri

Columbia, MO 65211

Phone: 573-882-3335

Fax: 573-882-4195

Web: [www.physics.missouri.edu](http://www.physics.missouri.edu)

For information about applying to MU, call or write:

Office of Admissions

230 Jesse Hall

Columbia, MO 65211-1300

Phone: 573-882-7786

800-225-6075 (toll free in Missouri and Illinois)

Fax: 573-882-7887

E-mail: [mu4u@missouri.edu](mailto:mu4u@missouri.edu)

Web: [www.missouri.edu](http://www.missouri.edu)

*The University of Missouri does not discriminate on the basis of race, color, religion, national origin, ancestry, sex, age, disability or status as a disabled veteran or veteran of the Vietnam era. For more information, call Human Resource Services at 573-882-4256 or the U.S. Department of Education, Office of Civil Rights.*

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