DEPARTMENT OF PHYSICS

Undergraduate Study

Bachelor of Science in Physics (Course 8)

An undergraduate degree in physics provides an excellent basis not only for graduate study in physics and related fields, but also for professional work in such fields as astrophysics, biophysics, engineering and applied physics, geophysics, management, law, or medicine. The undergraduate curriculum offers students the opportunity to acquire a deep conceptual understanding of fundamental physics. The core departmental requirements begin this process. The student then chooses one of two options to complete the degree: the focused option (*https://catalog.mit.edu/degree-charts/physics-course-8/#focusedoptiontext*) is designed for students who plan to pursue physics as a career, and is an excellent choice for students who want to experience as deep an engagement as possible with physics; the flexible option (*https://catalog.mit.edu/degree-charts/physics-course-8/#flexibleoptiontext*) also provides a very strong physics framework, and gives students who may want to pursue additional academic interests the flexibility to do so. Both programs prepare students very well for graduate studies in physics, as well as for a variety of academic or research-related careers. Either option provides a considerable amount of time for exploration through electives. Students proceed at the pace and degree of specialization best suited to their individual capacities. Both options lead to the same degree: the Bachelor of Science in Physics.

Physics: Focused Option

This option—which includes three terms of quantum mechanics, 36 units of laboratory experience, and a thesis—is ideal preparation for a career in physics.

In the second year, students take:

8.03	Physics III	12
8.033	Relativity	12
8.04	Quantum Physics I	12
8.044	Statistical Physics I	12
8.223	Classical Mechanics II	6

Important skills for experimentation in physics may be acquired by starting an Undergraduate Research Opportunities Program (UROP) (*https://catalog.mit.edu/mit/undergraduate-education/academic-research-options/undergraduate-research-opportunities-program*) project.

In the third year, students normally take laboratory subjects:

8.13	Experimental Physics I	36
& 8.14	and Experimental Physics II	
8.05	Quantum Physics II	24
& 8.06	and Quantum Physics III	

Students should also begin to take the restricted elective subjects, one in mathematics and at least two in physics. The mathematics subjects 18.04 Complex Variables with Applications, 18.075 Methods for Scientists and Engineers, and 18.06 Linear Algebra are particularly popular with physics majors. Topical elective subjects in astrophysics, biological physics, condensed matter, plasma, and nuclear and particle physics allow students to gain an appreciation of the forefronts of modern physics. Students intending to go on to graduate school in physics are encouraged to take the theoretical physics sequence:

8.07	Electromagnetism II	12
8.08	Statistical Physics II	12
8.09	Classical Mechanics III	12

An important component of this option is the thesis, which is a physics research project carried out under the guidance of a faculty member. Many thesis projects grow naturally out of UROP projects. Students should have some idea of a thesis topic by the middle of the junior year. A thesis proposal must be submitted before registering for thesis units and no later than Add Date of the fall term of the senior year.

A relatively large amount of elective time usually becomes available during the fourth year and can be used either to deepen one's background in physics or to explore other disciplines.

Physics: Flexible Option

This option is designed for students who wish to develop a strong background in the fundamentals of physics and then build on this foundation as they prepare for career paths that may or may not involve a graduate degree in physics. Many students find an understanding of the basic concepts of physics and an appreciation of the physicist's approach to problem solving an excellent preparation for the growing spectrum of nontraditional, technology-related career opportunities, as well as for careers in business, law, medicine, or engineering. Additionally, the flexible option makes it more possible for students with diverse intellectual interests to pursue a second major in another department.

The option begins with the core subjects:

8.01	Physics I	12
8.02	Physics II	12
8.03	Physics III	12
8.04	Quantum Physics I	12
8.044	Statistical Physics I	12
8.21	Physics of Energy	12
or 8.223	Classical Mechanics II	

Students round out their foundation material with either an additional quantum mechanics subject (8.05 Quantum Physics II) or a subject in relativity (8.20 Introduction to Special Relativity or 8.033 Relativity). There is an experimental requirement of 8.13 Experimental Physics I or, with the approval of the department, a laboratory subject of similar intensity in another department, an experimental research project or senior thesis, or an experimentally oriented summer externship. An exploration requirement consists of one elective subject in physics. Students can satisfy the departmental portion of the Communication Requirement by taking two of the following subjects:

8.06	Quantum Physics III	12
8.13	Experimental Physics I	18
8.14	Experimental Physics II	18
8.225[J]	Einstein, Oppenheimer, Feynman: Physics in the 20th Century	12
8.226	Forty-three Orders of Magnitude	12
8.287[J]	Observational Techniques of Optical Astronomy	15

The department and the Subcommittee on the Communication Requirement may accept substitution of one of the department's two required CI-M subjects with a CI-M subject in another department if it forms a natural part of the student's physics program.

Students following this option must also complete a focus requirement—three subjects forming one intellectually coherent unit in some area (not necessarily physics), subject to the approval of the department and separate from those used by the student to satisfy the HASS requirement. Areas of focus chosen by students have included astronomy, biology, computational physics, theoretical physics, nanotechnology, history of science, science and technology policy, philosophy, and science teaching. Some students may choose to satisfy their experimental and exploration requirements in the same area as their focus; others may opt for greater breadth by choosing other fields to fulfill these requirements.

Although students may choose this option at any time in their undergraduate career, many decide on the flexible major during their sophomore year in order to have enough time to craft a program that best suits their individual needs. Specific subject choices for the experimental and focus requirements require the written approval of the Flexible Program coordinator, Dr. Sean P. Robinson.

Minor in Physics

The Minor in Physics provides a solid foundation for the pursuit of a broad range of professional activities in science and engineering. The requirements for a Minor in Physics are as follows:

18.03	Differential Equations [1]	12
Select five Course 8 subjects beyond the General Institute Requirements		57-60
Total Units		**69-72**

[1] *18.032 Differential Equations is also acceptable.*

Students should submit a completed Minor Application Form to Physics Academic Programs, Room 4-315. The Physics Department's minor coordinator is Shannon Larkin. See Undergraduate Education for more information on minor programs (*https://catalog.mit.edu/mit/undergraduate-education/academic-programs/minors*).

Minor in Astronomy

The Minor in Astronomy (*https://catalog.mit.edu/interdisciplinary/undergraduate-programs/minors/astronomy*), offered jointly with the Department of Earth, Atmospheric, and Planetary Sciences, covers the observational and theoretical foundations of astronomy. For a description of the minor, see Interdisciplinary Programs.

Inquiries

Additional information concerning degree programs and research activities may be obtained by contacting the department office (*physics-undergrad@mit.edu*), Room 4-315, 617-253-4841.