

MIT DEPARTMENT OF PHYSICS

Undergraduate Program

The Undergraduate Programs in Physics

Classes of 2015-2018

August 2014

The Physics Department offers two different programs leading to a Bachelor of Science in Physics, giving students the opportunity to tailor their study of physics to their individual career goals. The focused option is an ideal preparation for those students who plan to go on to graduate school in physics or a related field, while the flexible option provides a strong background in physics for those whose career paths may not include graduate work in the discipline.

Course VIII Focused Option

The Course VIII focused option is designed to provide the best possible preparation for graduate study in physics. Many students have also found this program to be an excellent, broad based preparation for professional work in related fields such as astrophysics, biophysics, geophysics, and many engineering disciplines. The focused option is unusual among pre-professional programs at MIT in that it offers a particularly large amount of elective freedom: as many as six subjects may be chosen as unrestricted electives without exceeding the minimum requirements for an undergraduate degree.

The Departmental program for the focused option consists of the following required subjects and restricted electives. The full requirements for the degree, including the General Institute Requirements, may be found in the MIT Bulletin. A typical focused option schedule showing how these required subjects might be distributed throughout a student's four undergraduate years is shown at the end of this document.

Focused Option Required Subjects

8.03	Physics III (vibrations and waves)
18.03 or 18.034	Differential Equations
8.033	Relativity
8.223 (IAP)	Classical Mechanics II
8.04	Quantum Mechanics I
8.044	Statistical Physics I
8.05	Quantum Mechanics II
8.06 CI-M*	Quantum Mechanics III
8.13 CI-M*	Experimental Physics I
8.14	Experimental Physics II
8.ThU	Thesis (12 units)

Focused Option Restricted Electives

- one subject given by the Mathematics Department beyond 18.03;

- two additional subjects given by the Physics Department beyond 8.02 including at least one of the following: 8.07, 8.08, 8.09

Course VIII 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 not involve a graduate degree in physics. In the past many students have found an understanding of the basic concepts of physics and an appreciation of the physicist's approach to problem solving an excellent preparation for careers in business, law, medicine or engineering. This option should be even more attractive today in light of the growing spectrum of non-traditional, technology-related career opportunities.

The freedom of choice associated with the flexible option does not preclude the possibility of going on to graduate school in physics. The number of physics subjects in this program is still comparable to that required of physics majors at many of our peer universities. Students who wish to pursue the flexible option should inform their departmental advisor during their sophomore year in order to have enough time to design a complete program. Specific plans for the experimental and focus requirements (see below) require the written approval of the Department's Flexible Option Coordinator.

The Departmental program for the flexible option consists of the following required subjects and restricted electives. The full requirements for the degree, including the General Institute Requirements, may be found in the MIT Bulletin. One possible four-year flexible schedule is shown at the end of this document.

Flexible Option Required Subjects

8.03	Physics III (vibrations and waves)
18.03 or 18.034	Differential Equations
8.04	Quantum Mechanics I
8.044	Statistical Physics II

and one of the following subjects:

8.05	Quantum Mechanics II, or
8.20	Introduction to Special Relativity, or
8.033	Relativity

and one of the following subjects:

8.223 (IAP)	Classical Mechanics II, or
8.21	Physics of Energy

and one of the following experimental experiences, subject to approval:

8.13 CI-M*	Experimental Physics I, or a laboratory subject of similar intensity in another dept., or an experimental research project or senior thesis, or an experimentally-oriented summer externship
------------	---

Flexible Option Restricted Electives

- one additional subject given by the Physics Department beyond 8.02;
- a three-subject focus group forming one coherent unit in some area, not necessarily physics, subject to the approval of the Department

Possible areas of focus include, but are not limited to, astronomy, biophysics, computational physics, nanotechnology, history of science, science and technology policy, philosophy of science, science teaching, pre-medical or pre-law programs, and management. Some students may choose to satisfy their experimental requirement and remaining restricted elective requirement in the same area as their focus; others may opt for greater breadth by choosing other fields for these requirements. The subjects in the focus group must be separate from those used to satisfy the student's HASS requirements. A physics subject included in the focus group may be used to satisfy the restricted elective requirement of one additional physics subject beyond 8.02, but may not be used to satisfy the experimental requirement.

*The departmental portion of the Communications Requirement in the flexible option can be satisfied by taking two of the following: 8.06, 8.13, 8.225J, 8.226, or 8.287J. The Department may support petitions to substitute any of these subjects with CI-M subjects from other departments if they form a natural part of the student's individual program. Such petitions must be approved by the Subcommittee on the Communications Requirement (SOCR).

The following examples of possible focus groups in different areas are not intended to be exhaustive. Other subjects may be used to comprise a focus in these areas, and other areas of focus may be proposed.

Examples of possible focus selections

Accelerator Physics

8.07 (4-0-8) Electromagnetism II

8.276 (4-0-8) Nuclear and Particle Physics

8.277 (units arranged) Introduction to Particle Accelerators

to satisfy the experimental requirement:

8.13 (0-6-12) Experimental Physics I or, with departmental approval, an externship in accelerator physics at a National Laboratory

Astronomy

12.400 (3-0-9) The Solar System

8.284 (3-0-9) Modern Astrophysics

8.286 (3-0-9) The Early Universe

to satisfy the experimental requirement:

12.410J (2-4-6) Observational Techniques of Optical Astronomy

Biophysics

7.03 (4-0-8) Genetics

7.05 (5-0-7) General Biochemistry

8.591 (4-0-8) Systems Biology

to satisfy the experimental requirement:

7.02 (2-8-5) Introduction to Experimental Biology

Computational Physics

6.004 (4-0-8) Computation Structures
18.330 (3-0-9) Introduction to Numerical Analysis
6.042J (5-0-7) Mathematics for Computer Science
to satisfy the experimental requirement:
8.13 (0-6-12) Experimental Physics I

Nanotechnology

8.231 (4-0-8) Physics of Solids I
6.152J (3-4-5) Microelectronics Processing Technology
6.781J (4-0-8) Nanostructure Fabrication
to satisfy the experimental requirement:
Summer externship at Lucent Technologies, Bell Laboratories

Philosophy of Science

8.06 (3-0-9) Quantum Physics III
24.111 (3-0-9) Philosophy of Quantum Mechanics
24.215 (3-0-9) Topics in the Philosophy of Science
to satisfy the experimental requirement:
8.13 (0-6-12) Experimental Physics I

History of Science

8.225 (3-0-9) Einstein, Oppenheimer, Feynman: Physics in the 20th Century
8.286 (3-0-9) The Early Universe
STS.003 (3-0-9) The Rise of Modern Science
to satisfy the experimental requirement:
8.13 (0-6-12) Experimental Physics I

Science Teaching

a relativity subject if not chosen under required subjects; otherwise, another core science subject beyond the GIRs
8.299 (arranged) Physics Teaching
11.124 (3-6-3) Introduction to Teaching and Learning Mathematics and Science
to satisfy the experimental requirement:
8.13 (0-6-12) Experimental Physics I

Management

14.01 (3-0-9) Principles of Microeconomics
14.02 (3-0-9) Principles of Macroeconomics
15.501 (3-0-9) Introduction to Financial and Management Accounting
to satisfy the experimental requirement:
8.13 (0-6-12) Experimental Physics I

Medicine or Law

a set of subjects comprising part of a pre-medical or pre-law program
(we suggest that the student consult with premed and pre-law advisors)