

PHYSICS

Course 8

Department Contact

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Description

Physicists explore and identify theories to explain the laws of nature and relationships between energy and matter. Physicists aspire to discover how the world works in both tangible and intangible realms and investigate topics ranging from subatomic particles to black holes and the overall structure of the universe. Physicists often utilize mathematical formulas to explain theories and make predictions. Individuals interested in physics frequently pursue opportunities in physics-based research and development, which often requires a Ph.D. Because of the experimental *and* theoretical nature of Physics, majors are well equipped to go into a variety of fields, including but not limited to Physics, Astronomy, Medicine, Data Science, AI, Machine Learning, Renewable Energy, Science Policy and Science Communication.

Inside Course 8

8 Physics

Introductory Classes

8.01 **Physics I**

Introduces classical mechanics. Space and time: straight-line kinematics; motion in a plane; forces and static equilibrium; particle dynamics, with force and conservation of momentum; relative inertial frames and non-inertial force; work, potential energy and conservation of energy; kinetic theory and the ideal gas; rigid bodies and rotational dynamics; vibrational motion; conservation of angular momentum; central force motions; fluid mechanics. Subject taught using the TEAL (Technology-Enabled Active Learning) format which features students working in groups of three, discussing concepts, solving problems, and doing table-top experiments with the aid of computer data acquisition and analysis.

8.012 **Physics I**

Elementary mechanics, presented in greater depth than in 8.01. Newton's laws, concepts of momentum, energy, angular momentum, rigid body motion, and non-inertial systems. Uses elementary calculus freely; concurrent registration in a math subject more advanced than 18.01 is recommended. In addition to covering the theoretical subject matter, students complete a small experimental project of their own design. Freshmen admitted via AP or Math Diagnostic for Physics Placement results.

8.02 **Physics II**

PHYSICS

Course 8

Introduction to electromagnetism and electrostatics: electric charge, Coulomb's law, electric structure of matter; conductors and dielectrics. Concepts of electrostatic field and potential, electrostatic energy. Electric currents, magnetic fields and Ampere's law. Magnetic materials. Time-varying fields and Faraday's law of induction. Basic electric circuits. Electromagnetic waves and Maxwell's equations. Subject taught using the TEAL (Technology Enabled Active Learning) studio format which utilizes small group interaction and current technology to help students develop intuition about, and conceptual models of, physical phenomena.

8.022 **Physics II**

Parallel to 8.02, but more advanced mathematically. Some knowledge of vector calculus assumed. Maxwell's equations, in both differential and integral form. Electrostatic and magnetic vector potential. Properties of dielectrics and magnetic materials. In addition to the theoretical subject matter, several experiments in electricity and magnetism are performed by the students in the laboratory.

Course 8-Friendly UROP Areas

- Francis Bitter Magnet Laboratory
- MIT Energy Initiative (EI)
- Inst for Data, Systems, Society (IDS)
- Materials Research Lab (MRL)
- Research Lab of Electronics (RLE)
- Plasma Science and Fusion Center (PSFC)
- Kavli Institute (MKI)
- MIT Center for Quantum Engineering
- MIT Lab for Nuclear Science (LNS)

Get Involved with Course 8

- Society of Physics Students (SPS)
- Undergraduate Womxn in Physics (UWIP)

Skills

- Using scientific rules and methods to solve problems
- Ability to design and perform hands-on experiments
- Ability to conduct and present research
- Technical writing and research proposal abilities
- Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.

PHYSICS

Course 8

Possible Future Jobs

- **Physicist:** Conducts research into the phases of physical phenomena, develops theories/laws on the basis of observation and experiments, and devises methods to apply laws/theories to industry and other fields.
- **Field test engineer:** Develop/upgrade instrumentation and software for control and analysis, document test procedures and experimental setups, and analyze and document the results of the tests.
- **Researcher:** Conducts experiments, analyzes findings, operates necessary equipment, develops and tests theories.
- **Data analyst:** Analyzes problems and comes up with creative solutions to a variety of problems in applications such as aerospace, sales, or inventory.

Career Industry Examples

Aerospace and defense	Computer hardware	Financial services
Automotive	Computer software	Government
Communications	Consulting	Nuclear Physics

Sample Employers

Benchling	Honeywell	Northrop Grumman
Cool Composites	Lincoln Laboratory	Sandia National Laboratory
Factual	McMaster-Carr	Warburg Pincus