

PHYSICS (BS)

CIP: 40.0801

Program Description

Physics is a broad discipline, ranging from fundamental scientific questions to sophisticated technological applications. At its most basic, it is the study of matter and energy and their manifold interactions. Physicists study topics as wide-ranging as the underlying nature of space and time; the origins, large-scale structure, and future evolution of the universe; the behavior of stars and galaxies; the fundamental constituents of matter; the many different patterns in which matter is organized, including superconductivity, liquid crystals, or the various forms of magnetism in solids; the workings of biological matter, whether in molecules such as DNA, or cellular structures, or the transport of matter and energy in and across cells. Basic physics research has led to myriad technological advances. A small list of these advances includes: radio and television; computers; lasers; X-rays; magnetic resonance imaging and CAT scans; and the World Wide Web.

Physics is a hands-on discipline, and students gain expertise not only in the classroom but also in the laboratory. Those trained in physics are found in many occupations, such as various fields of engineering, computer technology, health, environmental and earth sciences, communications, and science writing. They participate in activities ranging from the writing of realistic computer games to the modeling of financial activities, as well as the more traditional activities of physicists. A higher degree opens the possibility of creative research in industry, or teaching and research in colleges and universities. Outstanding and highly motivated students are offered special opportunities for independent study, summer laboratory research, internships, and other enhancements.

In addition to Foundations of Science 1-6 and six required courses in physics, the major requires four mathematics courses and one physics elective. Although not required, Complex Analysis and Partial Differential Equations are especially relevant to physics, and students are encouraged to complete one or both. At least one additional physics elective is strongly recommended.

The study away pathway for the Physics major can be found on the NYUAD Student Portal at students.nyuad.nyu.edu/pathways (<http://students.nyuad.nyu.edu/pathways/>). Students with questions should contact the Office of Global Education.

The program recommends that not more than one physics elective be taken while studying away.

Specialization in Astrophysics for Physics Majors Only

The Physics major offers a specialization in Astrophysics. Astrophysics employs the principles of physics and chemistry to explain the nature of astronomical objects. The objects studied cover the entire spectrum of celestial bodies, including the Sun and its planets, extrasolar planets, stars, galaxies, the interstellar and intergalactic medium and the cosmos as a whole.

Emission from these objects are examined across all parts of the electromagnetic spectrum, and the properties examined include luminosity, density, temperature, and chemical composition. Because astrophysics is a very broad subject, astrophysicists apply concepts and methods from many disciplines of physics, including mechanics, electromagnetism, statistical mechanics, thermodynamics, quantum

mechanics, relativity, nuclear and particle physics, and atomic and molecular physics.

Physics majors who elect to complete the Astrophysics specialization must complete all courses required for the Physics majors and four astrophysics electives selected from the list below. One of these courses can be used to satisfy the elective requirement for the Physics major. The other three would be in addition to the minimum elective requirements for the major. At least one of the astrophysics electives must be a lab requirement. Additionally, note that PHYS-UH 3220 Imaging and Spectroscopy Lab and PHYS-UH 3221 Radio Imaging and Time Series Lab are half courses and both would be needed to satisfy one of the requirements for the specialization (or the major).

Specialization in Biophysics for Natural Science Majors

The Biology, Chemistry, and Physics majors offer a specialization in Biophysics which emphasizes the crosstalk between these three disciplines in understanding biological function.

Everything obeys the laws of physics, and biological systems are no exception. The complexity of biological systems, however, is compounded by the fact that they span a broad range of interacting spatial scales from a few atoms to global ecosystems, and that life inherently functions far from the equilibrium. This complexity poses problems for physicists, chemists, and biologists that are at once interesting and challenging. Biophysics addresses these problems through an interdisciplinary approach that builds on strengths in physics, chemistry, and biology.

Physics majors who elect to complete the Biophysics specialization must complete all courses required for the Physics majors, three required Biophysics courses, and one elective selected from the list below. No more than two of these courses can be used to satisfy the elective requirement for the Chemistry major. The other two would be in addition to the minimum elective requirements for the major.

Admissions

New York University's Office of Undergraduate Admissions supports the application process for all undergraduate programs at NYU. For additional information about undergraduate admissions, including application requirements, see How to Apply (<https://www.nyu.edu/admissions/undergraduate-admissions/how-to-apply.html>).

Program Requirements

Course	Title	Credits
General Education Requirements		
Colloquia		8
First-Year Seminar		4
Arts, Design, and Technology		4
Cultural Exploration Analysis		4
Data and Discovery		4
Structures of Thought and Society		4
January Term Courses (3 courses)		12
Foundations of Science		
Complete 6.5 courses from SCIEN-UH 1101EQ–1603 Foundations of Science 1-6		26
Required Courses		
PHYS-UH 2010	Electromagnetism and Special Relativity (half course)	2

PHYS-UH 3010	Mechanics	4
PHYS-UH 3011	Electricity and Magnetism	4
PHYS-UH 3012	Quantum Mechanics 1	4
PHYS-UH 3013	Advanced Physics Laboratory	4
PHYS-UH 3014	Statistical Mechanics and Thermodynamics	4
Mathematics Courses		
MATH-UH 1012Q	Calculus with Applications to Science and Engineering	4
MATH-UH 1020	Multivariable Calculus with Applications to Science and Engineering	4
MATH-UH 1022	Linear Algebra	4
MATH-UH 2010	Ordinary Differential Equations	4
Elective		
Select one Physics elective		4
Research Seminar		
PHYS-UH 3090	Research Seminar in Physics (half course)	2
Capstone		
PHYS-UH 4001	Capstone Project in Physics 1	4
PHYS-UH 4002	Capstone Project in Physics 2	4
Other Elective Credits		22
Total Credits		140

Specializations

Astrophysics (for Physics Majors Only)

Course	Title	Credits
PHYS-UH 3211	General Relativity	4
PHYS-UH 3213	Computational Physics	4
PHYS-UH 3214	Astrophysics	4
PHYS-UH 3217	Multi-wavelength Astronomy	4
PHYS-UH 4216	Nuclear Astrophysics	4
PHYS-UH 3220	Imaging and Spectroscopy Lab (2 credits–Lab class)	2
PHYS-UH 3222	X Ray Astronomy Lab (2 credits–Lab class)	2
PHYS-UH 3221	Radio Imaging and Time Series Lab (2 credits–Lab class)	2
PHYS-UH 3215	Introduction to Detector Electronics (2 credits–Lab class)	2

At least 4 credits must be obtained from classes marked as Lab. The physics electives from this list will also count towards the one elective needed to satisfy the physics major requirements.

Biophysics (for Natural Science Majors)

Course	Title	Credits
Required Courses		
BIOL-UH 3130	Biophysics	4
PHYS-UH 3219	Biological Physics: From single molecules to the cell (can be used towards major elective)	4
CHEM-UH 3130	Computational Biology & Biophysics	4
Electives		
Select four of the following:		16
BIOL-UH 2010	Human Physiology	
BIOL-UH 2114	Genetics	

BIOL-UH 3115	Genome Biology	
BIOL-UH 3116	Immunology	
BIOL-UH 3218	Synthetic Biology	
BIOL-UH 3220	Experimental Systems Biology	
CHEM-UH 3020	Biochemistry: Macromolecular Structure and Function	
CHEM-UH 3011	Physical Chemistry: Thermodynamics and Kinetics	
CHEM-UH 3016	Analytical Chemistry	
CHEM-UH 3260	Special Topics in Chemistry (NMR only)	
Total Credits		28

Sample Plan of Study

Course	Title	Credits
1st Semester/Term		
MATH-UH 1012		4
First-Year Seminar		4
Colloquium		4
Elective Course		4
Credits		16
2nd Semester/Term		
Elective Course		4
Credits		4
3rd Semester/Term		
MATH-UH 1020	Multivariable Calculus with Applications to Science and Engineering	4
Elective Course		4
Core Courses		4
Credits		12
4th Semester/Term		
PHYS-UH 2010	Electromagnetism and Special Relativity	4
Colloquium		4
Credits		8
5th Semester/Term		
Elective Course		4
Credits		4
6th Semester/Term		
MATH-UH 1022	Linear Algebra	4
Core Courses		4
Credits		8
7th Semester/Term		
PHYS-UH 3013	Advanced Physics Laboratory	4
MATH-UH 2010	Ordinary Differential Equations	4
PHYS-UH 3012	Quantum Mechanics 1	4
PHYS-UH 3010	Mechanics	4
PHYS-UH 3090	Research Seminar in Physics	4
Credits		20
8th Semester		
General Elective		4
Credits		4
9th Semester/Term		
Abroad		
Credits		0
10th Semester/Term		
PHYS-UH 4001	Capstone Project in Physics 1	4
PHYS-UH 3014	Statistical Mechanics and Thermodynamics	4
Elective Course		4

Physics Elective	4
Credits	16
11th Semester/Term	
PHYS-UH 4002	Capstone Project in Physics 2
4	4
Core Courses	4
Elective Course	4
Elective Course	4
Credits	16
Total Credits	108

Learning Outcomes

Upon graduation, NYU Abu Dhabi students who major in Physics will have acquired:

1. Knowledge of Physics, Mathematics, and foundational Biology and Chemistry. Graduates who major in this program will possess advanced theoretical knowledge of the fundamental physical concepts believed to govern the behavior of everything in the universe, as well as the basic mathematical tools needed to understand and communicate physics, plus how they relate to basic biology and chemistry.
2. Knowledge of specific areas of scientific research. Graduates who major in this program will possess knowledge on one or more contemporary advanced research topics in Physics.
3. Analytical and Computer Aided Problem solving. Graduates who major in this program will have the capability of assess problems in physics and mathematics making use of scaling relations, symmetries, dimensional analysis, and estimation, and eventually get to an analytical or numerical solution using mathematical tools or computer calculations.
4. Experimental Research skills. Graduates who major in this program will possess the skills to operate research grade experimental equipment. They will be able to get data out of the equipment, and analyse their significance using error theory and statistical tools. They will learn how to work in a collaborative environment.
5. Scientific communication. Graduates who major in this program will be able to communicate their (or others') findings in oral (public presentation) and written (peer reviewed journals) form.
6. Critical thinking and analysis. Graduates who major in this program will be able to critically analyse and fruitfully discuss a scientific topic in physics. In particular, in the area of expertise mastered with PLO 2 they will be able to propose paths (either experimental or theoretical) for the advancement of that sector.

Policies

NYU Policies

University-wide policies can be found on the New York University Policy pages (<https://bulletins.nyu.edu/nyu/policies/>).

NYU Abu Dhabi Policies

A full list of relevant policies can be found on NYU Abu Dhabi's undergraduate academic policies page (<https://bulletins.nyu.edu/undergraduate/abu-dhabi/academic-policies/>).