# **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; and many others. Basic physics research has led to myriad technological advances, which have transformed society in the 20th century through the present day; a small list 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 our students gain expertise not only in the classroom but also in the laboratory. They may participate in activities ranging from the writing of realistic computer modeling of fundamental physical principles to the modeling of financial activities, as well as the more traditional activities of physicists and mathematicians. Those trained in physics are found in many occupations, such as various fields of engineering, computer technology, health, environmental and earth sciences, communications, finance, and science writing. 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 honors work, independent study, summer laboratory research, internships, and other enhancements. Our interdisciplinary approach and experimental work is geared to meet the current demand for scientists with well-integrated backgrounds who became the leaders in modern scientific scholarship and who pursue careers in research, education, industry, health care, business, and publishing.

# **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 |
|---------------------|---------------------------------------|---------|
| Core Courses        |                                       |         |
| Social and Cultura  | l Foundations                         |         |
| CCSF-SHU 101L       | <b>Global Perspectives on Society</b> | 4       |
| Interdisciplinary F | Perspectives on China (Two Courses)   | 8       |
| Writing             |                                       |         |
| WRIT-SHU 102        | Writing as Inquiry                    | 4       |
| WRIT-SHU 201        | Perspectives on the Humanities        | 4       |
| Language            |                                       |         |
| Language Courses    |                                       | 8-16    |
| Mathematics         |                                       |         |

| MATH-SHU 131                          | Calculus   | 4     |
|---------------------------------------|--|-------|
| Algorithmic Thinki                    | ng   |       |
| Algorithmic Think                     | ing Course   | 4     |
| Science                               |  |       |
| Experimental Disc<br>Major Courseworl | covery in the Natural World Requirement Fulfilled<br>k | d by  |
| Science, Technolo<br>Coursework       | ogy, and Society Requirement Fulfilled by Major        |       |
| Major Requireme                       | nts  |       |
| Foundational Cour                     | ses  |       |
| CHEM-SHU 125                          | Foundations of Chemistry I                             | 3     |
| CHEM-SHU 126                          | Foundations of Chemistry II                            | 3     |
| CHEM-SHU 127                          | Foundations of Chemistry I Lab                         | 2     |
| or CHEM-<br>SHU 128                   | Foundations of Chemistry II Lab                        |       |
| PHYS-SHU 11                           | General Physics I                                      | 3     |
| or PHYS-<br>SHU 91                    | Foundations of Physics I Honors                        |       |
| PHYS-SHU 93                           | Foundations of Physics II Honors                       | 3     |
| PHYS-SHU 95                           | Foundations of Physics III Honors                      | 3     |
| PHYS-SHU 96                           | Foundations of Physics IV Honors                       | 3     |
| PHYS-SHU 71                           | Foundations of Physics Lab I                           | 2     |
| PHYS-SHU 94                           | Foundations of Physics Lab II                          | 2     |
| Required Courses                      |  |       |
| MATH-SHU 140                          | Linear Algebra   | 4     |
| MATH-SHU 151                          | Multivariable Calculus                                 | 4     |
| MATH-SHU 235                          | Probability and Statistics                             | 4     |
| PHYS-SHU 106                          | Mathematical Physics                                   | 4     |
| PHYS-SHU 251                          | Electricity and Magnetism                              | 4     |
| PHYS-SHU 302                          | Statistical Mechanics and Thermodynamics               | 4     |
| PHYS-UA 123                           | Quantum Mechanics I                                    | 3     |
| PHYS-SHU 303                          | Advanced Physics Laboratory                            | 4     |
| PHYS-SHU 998                          | Integrated Science Capstone                            | 4     |
| Physics Electives                     |  |       |
| Select three of the                   | e following:   | 11    |
| PHYS-<br>SHU 135                      | Solid-State Physics                                    |       |
| PHYS-<br>SHU 201                      | Introduction to Quantum Computing                      |       |
| PHYS-GA 7001                          | Introduction to Quantum Communication                  |       |
| Other Elective Cre                    | edits  | 16-25 |
| Total Credits                         |  | 131   |

# Sample Plan of Study

| Course                              | Title  | Credits |
|-------------------------------------|--|---------|
| 1st Semester/Term                   |  |         |
| CCSF-SHU 101L                       | Global Perspectives on Society                 | 4       |
| MATH-SHU 131                        | Calculus                                       | 4       |
| PHYS-SHU 91                         | Foundations of Physics I Honors                | 3       |
| PHYS-SHU 71                         | Foundations of Physics Lab I                   | 2       |
| CHEM-SHU 125 Found<br>(recommended) | dations of Chemistry I or Core Language Course | 3 or 4  |
|                                     | Credits  | 16-17   |
| 2nd Semester/Term                   |  |         |
| WRIT-SHU 102                        | Writing as Inquiry                             | 4       |

| MATH-SHU 151                | Multivariable Calculus                      | 4       |
|-----------------------------|---|---------|
| PHYS-SHU 93                 | Foundations of Physics II Honors            | 3       |
| PHYS-SHU 94                 | Foundations of Physics Lab II               | 2       |
| CHEM-SHU 126 Foundati       | ons of Chemistry II or Core Language Course | 3 or 4  |
| (recommended)               |   |         |
|                             | Credits                                     | 16-17   |
| 3rd Semester/Term           |   |         |
| WRIT-SHU 201                | Perspectives on the Humanities              | 4       |
| MATH-SHU 140                | Linear Algebra                              | 4       |
| PHYS-SHU 95                 | Foundations of Physics III Honors           | 3       |
| CHEM-SHU 127                | Foundations of Chemistry I Lab              | 2 or 3  |
| or CHEM-SHU 125             | or Foundations of Chemistry I               |         |
| MATH-SHU 235                | Probability and Statistics                  | 4       |
|                             | Credits                                     | 17-18   |
| 4th Semester/Term           |   |         |
| PHYS-SHU 96                 | Foundations of Physics IV Honors            | 3       |
| PHYS-SHU 106                | Mathematical Physics                        | 4       |
| CHEM-SHU 126                | Foundations of Chemistry II                 | 3       |
| Chinese or EAP              |   | 4       |
|                             | Credits                                     | 14      |
| 5th Semester/Term           |   |         |
| PHYS-SHU 251                | Electricity and Magnetism                   | 4       |
| PHYS-UA 123                 | Quantum Mechanics I                         | 3       |
| Physics Elective            |   | 4       |
| Chinese or General Election | ve  | 4       |
|                             | Credits                                     | 15      |
| 6th Semester/Term           |   |         |
| PHYS-SHU 302                | Statistical Mechanics and Thermodynamics    | 4       |
| Physics Elective            |   | 4       |
| General Elective            |   | 4       |
| Chinese or General Election | ve  | 4       |
|                             | Credits                                     | 16      |
| 7th Semester/Term           |   |         |
| PHYS-SHU 998                | Integrated Science Capstone                 | 4       |
| Physics Elective            |   | 4       |
| Core Course or General E    | lective                                     | 4       |
| Core Course or General E    | lective                                     | 4       |
|                             | Credits                                     | 16      |
| 8th Semester/Term           |   |         |
| PHYS-SHU 303                | Advanced Physics Laboratory                 | 4       |
| Core Course or General E    | lective                                     | 4       |
| General Elective            |   | 4       |
| General Elective            |   | 4       |
| General Elective            |   | 2       |
|                             | Credits                                     | 18      |
|                             | Total Credits                               | 128-131 |
|                             |   |         |

### **Learning Outcomes**

Upon successful completion of this program, students will:

- 1. Demonstrate an understanding of core knowledge in physics and also apply these concepts, knowledge and numerical techniques to new situations or datasets to solve problems.
- Synthesize data (e.g., from experiments or observations) by designing and executing scientific experiments, and conducting relevant statistical tests.
- 3. Construct models that describe how physical phenomena occur by analyzing scientific data.
- 4. Effectively communicate their problem-solving rationale or research work in spoken, visual and written form.

- 5. Critically evaluate their own works, as well as those of their peers and works from the current literature in physical sciences.
- 6. Display routine practice of laboratory safety, including performing risk assessments, following established safety protocols, using appropriate personal protective equipment, and maintaining detailed laboratory notebooks.

# Policies

#### **Program Policies**

- Students who did not attend a Chinese-medium high school fulfill the Core language requirement by demonstrating proficiency of the Chinese language through the Intermediate level. Chinese speakers who did not attend an English-medium high school fulfill the Core language requirement through completion of EAP-SHU 100 English for Academic Purposes I and EAP-SHU 101 English for Academic Purposes II. Additional information can be found on the NYU Shanghai Core Curriculum page (https://bulletins.nyu.edu/ undergraduate/shanghai/core-curriculum/#text).
- 2. A note on the relationship between General Physics and Foundations of Physics Honors: General Physics I & II is a calculus-based course for pre-meds, engineers and others who want a broad introduction and survey of basic physics including classical mechanics, electricity and magnetism, optics and waves, and thermal and statistical physics. Foundations of Physics I-IV Honors covers a similar set of topics in considerably greater depth, plus special relativity and an introduction to quantum mechanics, over four semesters. It should be emphasized that Foundations of Physics I & II Honors alone do not include some important topics, such as optics, thermal and statistical physics, which are included in Foundations of Physics III Honors, and introduction to quantum mechanics and condensed matter physics in Foundations of Physics IV Honors. Therefore, students electing to take the Honors Physics track are highly recommended to take Foundations of Physics III Honors and Foundations of Physics IV Honors as well.
- 3. Students who have taken General Physics I and received a B+ or better grade also satisfy the prerequisite to take Foundations of Physics II Honors. Such students may also become Physics Majors and do not have to retake Foundations of Physics I Honors. However, students who already are interested in majoring in Physics, as well as those interested in the honors track, or those with a strong high-school background in physics and mathematics are strongly recommended to take Foundations of Physics I-IV Honors.

### Prerequisite Courses for Declaring a Major

Final grade of C/ current semester midterm grade of B or higher in Foundations of Physics II.

### **Minimum GPA**

Physics, Chemistry and Electrical Engineering majors' students must achieve and maintain a minimum 3.0 cumulative and major GPA in order to declare the major. Since they are required to study away in NY or AD for their junior year in order to complete major coursework offered at those campuses, they must complete all of the prerequisite courses at NYU Shanghai for the junior year major classes they need to take in New York or AD before they will be admitted to study away. If declared majors fail to maintain a 3.0 GPA or do not complete the required courses during study away, they may be required to declare a different major to be able to graduate.

### **NYU Policies**

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

### **NYU Shanghai Policies**

Additional academic policies can be found on the NYU Shanghai Academic Policies page (https://bulletins.nyu.edu/undergraduate/ shanghai/academic-policies/).