

Minor in Philosophy

Students who wish to minor in Philosophy must take at least 15 hours in courses in the specific area, including at least nine semester hours at the 3000 level or above. Students taking more than 15 hours in courses in the specific area may count the additional hours toward their electives or may consider completing a double major. A grade of C or higher is required in all courses counting toward the minor.

Minor in Ethics (see section 3250)

3450 Physics

Programs Offered:

Bachelor of Science in Physics

Standard Program in Physics

Concentration in Applied Physics

Concentration in Astronomy

Concentration in Biophysics

Concentration in Computer Science

Concentration in Geology

Concentration in Pre-Medicine

Minor in Physics

Department of Physics and Astronomy

400 Science Annex

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All degree programs described below are built on a core of 22 semester hours of physics numbered 3400 or above and establish a strong background in mathematics by providing nine semester hours of 3000 and 4000-level courses. The standard program is designed to prepare the student for graduate school or immediate employment upon graduation. Students selecting the standard program must complete 15 semester hours of physics and mathematics beyond the core set of physics and mathematics courses listed below. As an alternative to the standard program, courses in one of several specific areas of concentration may be chosen as described below. The available areas of concentration are applied physics, astronomy, pre-medicine, biophysics, geology, and computer science.

A central objective of Georgia State University is that all graduates from its programs will be proficient in writing, critical and analytical thinking, and use of information resources. In support of this objective, the Department of Physics and Astronomy explicitly incorporates activities to develop these skills as appropriate in each course.

To schedule an effective program of study, it is very important that all students intending to major in physics consult with the physics faculty adviser as soon as possible. Physics majors should pay special attention to the early completion of the mathematical requirements if they are to complete their physics requirements during the usual four-year span. The first calculus course should be taken during the freshman year, and the second and third calculus courses should be completed during the sophomore year. The department recommends that General Chemistry I and II be taken during the freshman year. The beginning physics sequence (Physics 2211K-2212K) should be completed before the end of the sophomore year. Students who enter the physics major after completing a non-calculus level elementary physics sequence should consult with their departmental adviser on the best method of preparing for more advanced courses in physics.

The degree programs described below do not require a foreign language. However, the department recommends that students continue their high school experience to a level of competency equivalent to Georgia State's 1002 level or higher.

Program Degree Requirements

In addition to the Program Degree Requirements, students must fulfill the College of Arts and Sciences Degree Requirements (see section 3030) and the University Degree Requirements (see section 1400).

B.S. in Physics**Areas A-E: Core Curriculum Recommendations**

1. Required course:
Math 1113 Precalculus (3) (or a higher-level mathematics course)
2. Required course:
Math 2211 Calculus of One Variable I (4) (or a higher-level mathematics course)
3. Recommended courses:
Chem 1211K General Chemistry I (4)
Chem 1212K General Chemistry II (4)

Area F: Courses Appropriate to the Major (18)*

1. Required Courses (18) (Unless used to satisfy Area D requirements)
Phys 2211K Principles of Physics I (4)
Phys 2212K Principles of Physics II (4)
Chem 1211K General Chemistry I (4)
Chem 1212K General Chemistry II (4)
Math 2212 Calculus of One Variable II (4)
2. Math 2215 Multivariate Calculus (4)*
3. To complete 18 semester hours in Area F, select additional courses from the following list that were not used to satisfy the Area A or D requirements.*
Biol 1103K Introductory Biology I (4)
Biol 1104K Introductory Biology II (4)
Biol 2107K Principles of Biology I (4)
Biol 2108K Principles of Biology II (4)
CSc 2310 Principles of Computer Programming I (3)
CSc 2311 Principles of Computer Programming II (3)
Geol 1121K Introductory Geosciences I (4)
Geol 1122K Introductory Geosciences II (4)

***Required Lower Division Courses**

All students majoring in physics must complete the following set of courses: Phys 2211K, 2212K, Chem 1211K, 1212K, Math 2212, and 2215. Any semester hours exceeding 18 earned to complete the lower division and Area F requirements will count toward elective hours.

Area G: Major Courses

A grade of C or higher is required in all major courses. The Department of Physics and Astronomy offers several concentrations within the B.S. degree program for the physics major. The standard program is recommended for those who plan to pursue graduate study in physics, or who plan to seek immediate employment upon graduation. Other options include concentrations in applied physics, astronomy, pre-medicine, biophysics, geology, and computer science. Course requirements listed below for each of the options are in addition to the courses listed under Area F and the required lower division courses listed above. The standard program and all concentrations are centered on the 22-hour core of physics courses and the nine-hour core of mathematics courses listed below.

Physics Core (22)

1. Physics Requirements (21)
Phys 3401 Modern Physics I (4)
Phys 3402 Modern Physics II (3)
Phys 3850 Statistical and Thermal Physics (3)
Phys 3901 Modern Physics Laboratory I (1)
Phys 3902 Modern Physics Laboratory II (1)
Phys 4600 Classical Mechanics (4)
Phys 4700 Electricity and Magnetism (4)
Phys 4950 Senior Research (1)
2. Select one physics or astronomy laboratory course at the 4000 level. (1)

Mathematics Core (9)

- Mathematics Requirements (9)
Math 3260 Differential Equations (3)

Math 4258	Vector Calculus (3)
Math 4265	Partial Differential Equations (3)

Standard Program in Physics (15)

To meet the requirements for the degree with the standard program, the core set of physics and mathematics courses must be completed along with additional physics and mathematics courses as described below:

1. Required course (1)
One physics laboratory course at the 4000 level (1)
2. Physics and Astronomy Courses. Select eleven hours from the following (11):

Phys 3500	Electronics (3)
Phys 3800	Optics (3)
Phys 4110	Introduction to Embedded Systems Laboratory (4)
Phys 4410	Introduction to Nuclear and Particle Physics (3)
Phys 4810	Introduction to Quantum Mechanics (3)
Phys 4910	Solid State Physics (3)
Phys 4950	Senior Research (1-2)
Astr 3500	Fundamentals of Astronomy and Astrophysics (4)
Astr 4000	Fundamentals of Astrophysics (3)
Astr 4100	Astronomical Techniques and Instrumentation (3)

One physics or astronomy laboratory course at the 4000 level (1)
3. Mathematics and Computer Science Courses: Select one course. (3)

CSc 4610	Numerical Analysis I (3)
Math 3435	Introductory Linear Algebra (3)
Math 4250	Complex Analysis (3)
Math 4391	Introduction to Differential Geometry and Its Applications (3)

Applied Physics Concentration (18)

In addition to the core courses in physics and mathematics, the applied physics concentration allows courses from other sciences and engineering to complete the program in physics-related areas. Engineering courses are available through cross registration at the Georgia Institute of Technology. At least 15 semester hours must be completed at the 3000 level or above, and at least nine semester hours must be selected from science and/or engineering courses offered by other departments.

The overall program must be developed in consultation with a faculty adviser within the Department of Physics and Astronomy.

Astronomy Concentration (16)

In addition to the core set of physics and mathematics courses, the astronomy concentration consists of 11 semester hours in astronomy courses (Astr 3500, 4000, 4010, and 4100), and others from the list below, to complete the requirements for the degree. (Although not a requirement, the department recommends that students take Astr 1010 and/or Astr 1020 before the junior year.)

1. Required courses (11)

Astr 3500	Fundamentals of Astronomy and Astrophysics (4)
Astr 4000	Fundamentals of Astrophysics (3)
Astr 4010	Astronomical Methods Laboratory (1)
Astr 4100	Astronomical Techniques and Instrumentation (3)
2. Physics, Mathematics, and Computer Science Courses. Select five hours from the following: (5)

Phys 3500	Electronics (3)
Phys 3800	Optics (3)
Phys 4110	Introduction to Embedded Systems Laboratory (4)
Phys 4410	Introduction to Nuclear and Particle Physics (3)
Phys 4810	Introduction to Quantum Mechanics (3)
Phys 4910	Solid State Physics (3)
Phys 4950	Senior Research (1-2)

One physics or astronomy laboratory course at the 4000 level (1)

CSc 4610	Numerical Analysis I (3)
Math 3435	Introductory Linear Algebra (3)
Math 4250	Complex Analysis (3)
Math 4391	Introduction to Differential Geometry and Its Applications (3)

Pre-Medicine Concentration (19)

In addition to the core set of physics and mathematics courses, the pre-medicine concentration allows courses from biology and chemistry to complete the requirements for the degree. The concentration also provides the set of physics, chemistry, and biology courses required for admission to most medical schools. Note that Biol 2107K and 2108K are prerequisites for Biol 3800 and other upper-division biology courses.

1. Required Chemistry courses (12)
 - Chem 2400 Organic Chemistry I (4)
 - Chem 3410 Organic Chemistry II (4)
 - Chem 3100 Organic Chemistry Laboratory I (2)
 - Chem 3110 Organic Chemistry Laboratory II (2)
2. Required Biology courses. Select one of the following (3):
 - Biol 3240 Human Physiology (3)
 - Biol 3800 Molecular Cell Biology (3)
3. Electives. Select four hours from the following (4):
 - Biol 3240 Human Physiology (3) (unless used above)
 - Biol 3250 Human Physiology Laboratory (1)
 - Biol 3800 Molecular Cell Biology (3) (unless used above)
 - Biol 3810 Molecular Cell Biology Laboratory (2)
 - Biol 3880 Microbiology (3)
 - Biol 3890 Microbiology Laboratory (1)
 - Biol 3900 Genetics (3)
 - Biol 3910 Genetics Laboratory (1)
 - Chem 4600 Biochemistry I (5)

Biophysics Concentration (16)

In addition to the core set of physics and mathematics courses, the biophysics concentration allows biology and chemistry courses to complete the requirements for the degree. The courses should be chosen from the list below and provide background in several areas including biochemical, biomolecular, and neural sciences. This concentration provides excellent preparation for advanced study in biological physics and for admission to M.D./Ph.D. programs. Note that Biol 2107K and 2108K are prerequisites for Biol 3800 and other upper-division biology courses.

1. Required courses (7)
 - Biol 3800 Molecular Cell Biology (3)
 - Chem 2400 Organic Chemistry I (4)
2. Select nine hours from the following: (Chem 3410, Organic Chemistry II, is a prerequisite for many other courses listed.) (9)
 - Chem 3100 Organic Chemistry Laboratory I (2)
 - Chem 3110 Organic Chemistry Laboratory II (2)
 - Chem 3410 Organic Chemistry II (4)
 - Chem 4000 Fundamentals of Chemical Analysis (3)
 - Chem 4110 Physical Chemistry I (3)
 - Chem 4600 Biochemistry I (5)
 - Chem 4620 Biochemistry Laboratory I (2)
 - Chem 4840 Bioenergetics (3)
 - Biol 3810 Molecular Cell Biology Laboratory (2)
 - Biol 3840 Animal Biology (3)
 - Biol 3850 Animal Biology Laboratory (1)
 - Biol 3880 Microbiology (3)
 - Biol 3890 Microbiology Laboratory (1)
 - Biol 3900 Genetics (3)
 - Biol 3910 Genetics Laboratory (1)
 - Biol 4102 Fundamentals of Neurobiology (4)
 - Biol 4180 Neurobiology Laboratory (4)
 - Phys 3500 Electronics (3)

Geology Concentration (16)

In addition to the core set of physics and mathematics courses, this concentration allows geology courses to complete the requirements for the degree. The courses should be chosen from the list below. Note that Geol 1121K and 1122K are prerequisites for upper-division geology courses.

1. Required courses (4)
 - Geol 3002 Introduction to Earth Minerals (4)
2. Electives: Select 12 hours from the following (or other approved 3000-4000 geology courses) (12)
 - Geol 4007 Hydrogeology (4)
 - Geol 4013 Structural Geology (4)
 - Geol 4015 Crystallography and Optical Mineralogy (4)
 - Geol 4017 Environmental Geology (4)

Computer Science Concentration (16-17)

In addition to the core set of physics and mathematics courses, this option allows courses in computer science and related areas to complete the requirements for the degree. The courses should be chosen from the list below. Note that CSc 2310 and 2311 are prerequisites for upper-division computer science courses.

1. Required courses (13)
 - Phys 3500 Electronics (3)
 - CSc 3410 Data Structures (3)
 - CSc 4610 Numerical Analysis I (3)
 - CSc 4730 Scientific Visualization (4)
2. Select one course from the following: (3-4)
 - CSc 3210 Computer Organization and Programming (3)
 - CSc 4210 Computer Architecture (4)
 - CSc 4230 VLSI Design (4)
 - CSc 4250 VLSI CAD and Computer Architecture Laboratory (4)
 - CSc 4310 Parallel and Distributed Computing (4)
 - CSc 4620 Numerical Analysis II (3)
 - CSc 4820 Computer Graphics Algorithms (4)
 - Math 3030 Mathematical Models for Computer Science (3)
 - Math 3435 Introductory Linear Algebra (3)
 - Phys 4110 Introduction to Embedded Systems Laboratory (4)

Area H: Minor and/or Additional Courses

1. Students earning a B.S. through the Department of Physics and Astronomy are not required to take a minor.
2. Additional courses must be taken as electives to complete a minimum of 120 semester hours, exclusive of 1000/2000 physical education, health, or military science courses. Although not a requirement, the department recommends that physics majors take these elective courses at the 2000 level or above in mathematics, computer science, chemistry, biology, geology, physics, or astronomy. (Consult with the departmental academic adviser.)

Minor in Physics

Students who wish to minor in physics must take at least 15 semester hours in physics and/or astronomy courses, including at least seven semester hours at the 3000 level or above. Students taking more than 15 semester hours in these courses may count the additional hours toward their electives or may consider completing a double major. A grade of C or higher is required in all courses counting toward the minor.

3460 Political Science

Programs Offered:

- Bachelor of Arts in Political Science**
 - Concentration in General Political Science**
 - Concentration in International Affairs**
 - Concentration in Pre-Law**
 - Concentration in Pre-Education**
- European Union Studies Certificate**
- Minor in Political Science**