

DEPARTMENT OF PHYSICS

Science and Technology Center (McNulty Hall)

(973) 761-9050

www.shu.edu/artsci/physics (<http://www.shu.edu/artsci/physics/>)

Faculty: Lopez; Konjhodzic; Morales; Sahiner (*Chair*); Shojania-Feizabadi; Troha; Wang, Jiang, Morse.

Faculty Emeriti: Schleifer;

The Department of Physics offers major programs of study leading to the degree of Bachelor of Science (B.S.) and the degree of Bachelor of Arts (B.A.). The department provides students with a comprehensive grounding in the laws governing the behavior of matter. The intimate relationship between theory and experiment, and the open, dynamic character of physics are stressed. Topics of current interest in fundamental physics and modern technology receive special emphasis.

Students majoring in physics may choose one of the following three options leading to the degree of Bachelor of Science (B.S.):

1. **Applied Program** for students desiring a conventional program in physics to be followed by graduate work in physics or a related field;
2. **Industrial Program** for those who intend to seek employment in industry or government, or those considering a career in secondary education;
3. **Five-Year Dual Degree (B.S. in Physics +M.S. in Engineering) Program**
Seton Hall offers this unique 3+2 dual degree program in which students can earn a bachelor's degree in Physics plus a master's degree in Engineering in partnership with Stevens Institute of Technology. Earning two degrees in just five years will give students the skills and experiences to be more versatile and marketable when pursuing future employment or education. Students interested in Engineering will be able to pursue programs in Mechanical and Electrical Engineering, Artificial Intelligence, Civil or Construction Engineering and Management and Ocean Engineering. Transition to the graduate portion of the program at Stevens is contingent upon meeting the following conditions during your studies at Seton Hall:
 - a. Complete all required Physics course work outlined by your advisor in the first three years. Note, AP credits will not waive science requirements but can be applied as elective credit. Student needs to be placed in the right Math class (Calculus I) on their first semester and take Principle of Physics I and II and labs (or General Physics I and II and labs) on their first year and follow the course structure closely in order to finish the required courses from Seton Hall University in the first three years.
 - b. Maintain a minimum cumulative GPA of at least 3.2
 - c. Maintain a minimum cumulative GPA in all Math and Science courses of at least 3.0
 - d. Apply to the Master's portion of the program in the start of your spring semester of junior year

The Bachelor of Arts (B.A.) program is ideal for those who intend to seek employment in secondary education and those who wish to study physics and pursue professional careers in such fields as business, law, and allied health.

The sequence and diversity of courses for all students will be worked out in consultation with a department adviser who may modify the program in view of each student's background and objectives.

Major

- Physics Major (B.A.) (<http://catalogue.shu.edu/undergraduate/college-arts-sciences/department-physics/physics-major-ba/>)
- Physics Major (B.S.) (<http://catalogue.shu.edu/undergraduate/college-arts-sciences/department-physics/physics-major-bs/>)

Minor

- Physics Minor (<http://catalogue.shu.edu/undergraduate/college-arts-sciences/department-physics/physics-minor/>)

Accelerated and Dual Degree

- 3+2 B.S. in Physics from Seton Hall University/M.S. in Engineering or Artificial Intelligence from Stevens Institute of Technology (http://catalogue.shu.edu/undergraduate/college-arts-sciences/department-physics/accelerated_bs_physics_ms_engineering20or20artificial20intelligence/)
- Accelerated 3+2 Dual Degree Program in Physics (B.S.) and Applied Physics and Engineering (M.S.) (http://catalogue.shu.edu/undergraduate/college-arts-sciences/department-physics/accelerated_bs_physics_ms_engineering/)
- Accelerated 3+2 Dual Degree Program in Physics and Data Science (<http://catalogue.shu.edu/undergraduate/college-arts-sciences/department-physics/accelerated20320220physics20and20data20science/>)

Note to Students: The following listing represents those courses that are in the active rotation for each department, i.e., have been offered in the past five years. Some departments have additional courses offered more rarely but still available – to find the complete list of all official courses for a department, please use the “Course Catalogue Search” function in Self-Service Banner

Course Descriptions

PHYS 1001 Intro to Physical Science (3 Credits)

For non-science students. Emphasis on concepts and methods of physical sciences. Topics range from gravitation and astronomy to modern scientific frauds.

PHYS 1007 Intro to Astronomy (3 Credits)

Survey of the historical development and current status of astronomy. The solar system, stars and galaxies, quasars, pulsars, black holes and models of the universe and its history. Eight-inch and 16-inch telescopes are used for observation on clear nights.

PHYS 1701 General Physics I (3 Credits)

Mechanics, sound and heat. Corequisite: MATH 1401 MATH 1015 and PHYS 1811.

Prerequisites: MATH 1015 (may be taken concurrently) or MATH 1401 (may be taken concurrently) or MATH 1501 (may be taken concurrently)

PHYS 1702 General Physics II (3 Credits)

Elementary electricity and magnetism, optics and elementary modern physics. Corequisite: MATH 1411 and PHYS 1812.

PHYS 1705 Principles of Physics I (3 Credits)

Vectors, kinematics and dynamics, heat and thermodynamics, electricity and magnetism, introduction to Maxwell's equations, physical and geometrical optics and elementary modern physics. Corequisite: MATH 1401-1411 and PHYS 1815-1816 or permission of instructor.

PHYS 1706 Principles of Physics II (3 Credits)

Vectors, kinematics and dynamics, heat and thermodynamics, electricity and magnetism, introduction to Maxwell's equations, physical and geometrical optics and elementary modern physics. Corequisite: MATH 1401-1411 and PHYS 1815-1816 or permission of instructor.

Prerequisites: PHYS 1812 (may be taken concurrently) or PHYS 1816 (may be taken concurrently)

PHYS 1811 Physics Laboratory I (1 Credit)

Experiments in mechanics, sound, heat, light, electricity, and magnetism and radiation. Statistical analysis. Lab fee \$25 for each course.

Corequisite: MATH 1401-1411 or MATH 1015, and PHYS 1701-1702 or PHYS 1705-1706.

PHYS 1812 Physics Laboratory II (1 Credit)

Experiments in mechanics, sound, heat, light, electricity, and magnetism and radiation. Statistical analysis. Lab fee \$25 for each course.

Corequisite: MATH 1401-1411, and PHYS 1701-1702 or PHYS 1705-1706.

Prerequisites: (PHYS 1702 (may be taken concurrently) or PHYS 1706 (may be taken concurrently))

PHYS 1815 Physics Lab and Data Analy I (2 Credits)

Scientific programming with applications to data analysis in addition to all experiments in PHYS 1811. Additional topics include linear regression and numerical integration. Lab fee \$25. Corequisites: MATH 1401, PHYS 1705.

Prerequisites: MATH 1501 (may be taken concurrently) or MATH 1401 (may be taken concurrently)

PHYS 1816 Physics Lab and Data Analy II (1 Credit)

See PHYS 1812 Data analysis involves programs discussed in PHYS 1815. Prerequisite: PHYS 1815. Lab fee \$25. Corequisite: MATH 1411 and PHYS 1706.

Prerequisites: PHYS 1815 (may be taken concurrently)

PHYS 2112 Phys Appl of Math Techniques (4 Credits)

Selected applications of differential equations, vectors, matrices and determinants, Sturm-Liouville theory and orthogonal functions, numerical analysis, and probability and statistics to the physical sciences.

Prerequisite: MATH 2411 and PHYS 1706 or PHYS 1702.

Prerequisites: MATH 2411 (may be taken concurrently) and PHYS 1706 (may be taken concurrently) or PHYS 1702 (may be taken concurrently)

PHYS 2185 Intro to Modern Physics (4 Credits)

Special relativity, kinetic theory and thermodynamics, early quantum theory, atomic models, particle physics. Prerequisite: a year of general physics. Corequisite: MATH 2411 or permission of instructor.

PHYS 2186 Waves and Oscillations (3 Credits)

Oscillations of particles and rigid bodies; vibrations and waves in one to three dimensions; sound and electromagnetic waves. Prerequisite: MATH 2411, PHYS 2185.

Prerequisites: MATH 2411 (may be taken concurrently) and PHYS 2185 (may be taken concurrently)

PHYS 2883 Electronics I (3 Credits)

Circuit analysis; electronic instruments; digital and analog integrated circuits; microcomputer interfacing. One laboratory meeting per week. Prerequisite: a year of general physics. Corequisite: MATH 2411.

PHYS 3119 Math Methods of Physics I (4 Credits)

Vector analysis. Curvilinear coordinate systems. Determinants and matrices. Infinite series. Functions of a complex variable. Second order differential equations and Sturm-Liouville theory. Fourier series. Integral equations. Calculus of variations. Probability. Prerequisite: MATH 2411, PHYS 2112.

Prerequisites: MATH 2411 (may be taken concurrently) and PHYS 2112 (may be taken concurrently)

PHYS 3121 Mechanics I (3 Credits)

Newtonian mechanics; particle motion in one, two and three dimensions; systems of particles; rigid body motion; gravity; introductory Lagrangian formalism; small vibrations; special relativity; mechanics of continuous media. Prerequisite: PHYS 2186.

Prerequisites: PHYS 2186 (may be taken concurrently)

PHYS 3122 Mechanics II (3 Credits)

Newtonian mechanics; particle motion in one, two and three dimensions; systems of particles; rigid body motion; gravity; introductory Lagrangian formalism; small vibrations; special relativity; mechanics of continuous media. Prerequisite: PHYS 2186.

Prerequisites: PHYS 2186 (may be taken concurrently)

PHYS 3185 Electricity and Magnetism I (3 Credits)

Boundary value problems in electrostatics and magnetostatics; Maxwell's equations in differential form; time-dependent fields; plasma physics; radiation. Prerequisite: PHYS 2186.

Prerequisites: PHYS 2186 (may be taken concurrently)

PHYS 3186 Electricity and Magnetism II (3 Credits)

Boundary value problems in electrostatics and magnetostatics; Maxwell's equations in differential form; time-dependent fields; plasma physics; radiation. Prerequisite: PHYS 2186.

Prerequisites: PHYS 2186 (may be taken concurrently)

PHYS 3217 Modern Optics (3 Credits)

Mathematics of wave motion; physical optics, including polarization, diffraction and interference. Selected topics of current interest; fiber optics, integrated optics, lasers, holography and the principles of spectroscopy. Prerequisite: PHYS 2186.

Prerequisites: PHYS 2186 (may be taken concurrently)

PHYS 3812 Advanced Laboratory I (2 Credits)

PHYS 3811 and PHYS 3814 together cover a set of historically important experiments. PHYS 3812 and PHYS 3815 cover these same experiments to greater depth with additional topics. Lab fee \$25 for each course. Prerequisites: PHYS 2883. Fall Semester: PHYS 3811 (1 credit), 3812 (2 credits). Spring Semester: PHYS 3814 (1 credit), 3815 (2 credits).

Prerequisites: PHYS 2883 (may be taken concurrently)

PHYS 3815 Advanced Laboratory II (2 Credits)

PHYS 3811 and PHYS 3814 together cover a set of historically important experiments. PHYS 3812 and PHYS 3815 cover these same experiments to greater depth with additional topics. Lab fee \$25 for each course. Prerequisites: PHYS 2883. Fall Semester: PHYS 3811 (1 credit), 3812 (2 credits). Spring Semester: PHYS 3814 (1 credit), 3815 (2 credits).

Prerequisites: PHYS 2883 (may be taken concurrently)

PHYS 3894 Physics Internship I (3 Credits)**PHYS 4101 Special Topics (3 Credits)**

Selected topics in physics chosen by the instructor.

PHYS 4211 Quantum Mechanics I (3 Credits)

Wave mechanics in one and three dimensions, hydrogen atom, spin, exclusion principle and multi-electron atoms in external fields. Time-independent and time-dependent perturbation theory with applications, scattering theory. Prerequisites: CHEM 3412 or PHYS 2186; PHYS 3185.

Prerequisites: CHEM 3412 (may be taken concurrently) or PHYS 2186 (may be taken concurrently) and PHYS 3185 (may be taken concurrently)

PHYS 4212 Quantum Mechanics II (3 Credits)

Wave mechanics in one and three dimensions, hydrogen atom, spin, exclusion principle and multi-electron atoms in external fields. Time-independent and time-dependent perturbation theory with applications, scattering theory. Prerequisites: CHEM 3412 or PHYS 2186; PHYS 3185.

Prerequisites: CHEM 3412 (may be taken concurrently) or PHYS 2186 (may be taken concurrently) and PHYS 3185 (may be taken concurrently)

PHYS 4219 Statistical Physics (3 Credits)

Kinetic theory; quantum statistics; systems of interacting particles. Applications to solids. Prerequisite: PHYS 2186.

Prerequisites: PHYS 2186

PHYS 4290 Research in Physics I (2 Credits)

Introduction to the methods of original investigation in experimental or theoretical physics. (For selected seniors majoring in physics)

Prerequisite: permission of instructor.

PHYS 4812 Advanced Laboratory III (2 Credits)

Prerequisite: Permission of instructor. Fall Semester: PHYS 4811 (1 credit), 4812 (2 credits). Spring Semester: PHYS 4814 (1 credit), 4815 (2 credits). Supervised research.

PHYS 4815 Advanced Laboratory IV (2 Credits)

Lab fee \$25 for each course. Prerequisite: Permission of instructor. Fall Semester: PHYS 4811 (1 credit), 4812 (2 credits). Spring Semester: PHYS 4814 (1 credit), 4815 (2 credits). Supervised research.