PHYSICS AND ASTRONOMY

Physics is concerned with the properties of matter and the laws that describe its behavior. As a fundamental science, its discoveries and laws are basic to understanding in nearly all areas of science and technology. Advances in such diverse fields as medical instrumentation, solid state electronics, and space research have relied heavily on the application of basic physical laws and principles.

Students interested in the study of physics at the University of New Hampshire will find a strong interaction between research and academic programs. Undergraduates frequently participate in research studies ranging from nuclear scattering experiments at major particle accelerators to astrophysical studies of the solar system using space probes. These experiences have proven beneficial to engineering and physics students alike. The department is located in DeMeritt Hall (completed in 2008) and Morse Hall. Both buildings are equipped with state-of-the-art research facilities and laboratories. DeMeritt Hall also houses the physics library, classrooms, and a number of open and comfortable meeting areas, which provide an inviting atmosphere for study, interaction, and collaboration.

The suggested programs that follow are indicative of the flexibility available to students, whether they are preparing for graduate work in physics or astronomy, industrial opportunities, governmental research, secondary-level teaching, or a general education that might utilize the fundamental knowledge of physics.

Several undergraduate degree programs are offered through the department of physics. The B.S. degree is designed for students who wish to work as professional physicists or engineers. The B.A. degree is designed for students who want a strong background in physics but also want a broad liberal arts education. The department also offers a B.S. in engineering physics, which offers a deeper understanding of the physical principles needed to support careers in engineering. The BSEP program offers two tracks for students; aerospace and engineering research. Minors for astronomy and physics are also offered by the department.

Interested students are encouraged to contact the department for further information. More detailed information is also on the physics department website.

https://ceps.unh.edu/physics

Programs

- Engineering Physics Major (B.S.)
- Physics Major (B.A.)
- Physics Major (B.S.)
- Astronomy Minor
- Physics Minor

Courses

Physics (PHYS)

PHYS 400 - Physics Seminar I
Credits: 1
An informal reading and discussion course to introduce students to the general culture of physics, including career possibilities, historical and philosophical aspects of physics, current research at UNH and elsewhere, and physics in the news. Topics vary based on interests of the class. Students in their first year as physics majors (either as freshmen or transfers) are strongly encouraged to take this class.
Repeat Rule: May be repeated for a maximum of 2 credits.
Grade Mode: Credit/Fail Grading

PHYS 401 - Introduction to Physics I
Credits: 0 or 4
Broad survey of classical and modern physics. Designed to enable students to appreciate the role of physics in today's society and technology. Emphasizes the fundamental laws of nature on which all science is based, with some examples of interest to biologists. Knowledge of high school algebra, geometry, and trigonometry essential. Lab.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading

PHYS #401J - Introductory Physics Review I
Credits: 4
This course is for those who want to improve their understanding and their grade from Physics 401 before taking PHYS 402. Students must have passed the lab in PHYS 401 at UNH. This course will review all the topics from PHYS 401: motion, forces, energy, momentum, rotation, and fluids.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Prerequisite(s): PHYS 401 with a minimum grade of D-.
Equivalent(s): PHYS 401
Grade Mode: Letter Grading

PHYS 402 - Introduction to Physics II
Credits: 0 or 4
Broad survey of classical and modern physics. Designed to enable students to appreciate the role of physics in today's society and technology. Emphasizes the fundamental laws of nature on which all science is based, with some examples of interest to biologists. Knowledge of high school algebra, geometry, and trigonometry essential. Lab.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Prerequisite(s): PHYS 401 with a minimum grade of D-.
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 405 - Intro to Modern Astronomy
Credits: 4
Starting with a survey of the night sky and the daily motions of the stars and planets, this course surveys our current understanding of the Universe. It traces the development of the tools of the modern astronomer and how those tools have led to out theories of the solar system, the life cycle of stars, the formation of elements, the formation of galaxies and the evolution of the universe. Students explore in depth an astronomical topic of their choice through a term paper. The course includes direct experience with astronomical techniques and concepts through the use of the UNH Observatory and Small Radio Telescope, and a visit to a planetarium. Recommended for liberal arts and beginning science students. Knowledge of high school algebra is assumed. Note that this is the same course as PHYS 406, except for the substitution of a term paper instead of a lab. Cannot be taken for credit if credit received for PHYS 406.
Attributes: Physical Science(Discovery)
Equivalent(s): PHYS 406
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 406 - Introduction to Modern Astronomy
Credits: 0 or 4
Descriptive coverage of contemporary astronomical and astrophysical techniques with a review of current knowledge and theories concerning the solar system, galaxies, and the universe. Recommended for liberal arts and beginning science students. Knowledge of high school algebra is assumed. Note that this is the same course as PHYS 405, except for the substitution of a lab instead of a term paper. Cannot be taken for credit if credit received for PHYS 405. Lab.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Equivalent(s): PHYS 406H
Grade Mode: Letter Grading

PHYS 407 - General Physics I
Credits: 0 or 4
Introductory course emphasizing motion, forces, energy, momentum, rotation, and oscillations. Recommended for the student specializing in science and engineering. This version is the traditional format with three lectures, one recitation (problem solving section), and one lab each week. Students in this version must also register for a particular recitation and lab. Prereq: thorough knowledge of algebra, geometry, and trigonometry. Lab.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Prerequisite(s): MATH 425 (may be taken concurrently) with a minimum grade of D-.
Equivalent(s): PHYS 407H, PHYS #407J, PHYS 407S
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 407H - Honors/General Physics I
Credits: 0 or 4
Introductory course emphasizing motion, forces, energy, momentum, rotation, and oscillations. Recommended for the student specializing in science and engineering. The honors version covers the same material as the traditional lecture course, but with three two-hour classes per week,most of which is spent working on activities in groups (rather than lecture). Students in the Honors section must be co-enrolled in MATH 425H so that strong connections can be made between math and physics. 407H students work in groups in every class meeting. Students in this version do not register for a recitation or lab, since these activities are integrated into the regular class meetings. Prereq: thorough knowledge of algebra, geometry, and trigonometry. Lab.
Co-requisite: MATH 425H
Attributes: Discovery Lab Course; Honors course; Physical Science(Discovery)
Equivalent(s): PHYS 407, PHYS 407S
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading
Special Fee: Yes

PHYS #407J - General Physics Review I
Credits: 4
This course is for those students who want to improve their understanding and their grade from PHYS 407 before taking PHYS 408. Students must have passed the lab in PHYS 407 at UNH. This course will review all the topics from PHYS 407: motion, forces, energy, momentum, rotation, and oscillations.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Prerequisite(s): PHYS 407 with a minimum grade of D-.
Equivalent(s): PHYS 407
Grade Mode: Letter Grading

PHYS 407S - General Physics I Studio
Credits: 4
Introductory course emphasizing motion, forces, energy, momentum, rotation, and oscillations. Recommended for the student specializing in science and engineering. The Studio version covers the same material as the traditional lecture course, but with three two-hour classes per week, most of which is spent working on activities in groups (rather than lecture). Students in this version do not register for a recitation or lab since these activities are integrated into the regular class meetings. Prereq: thorough knowledge of algebra, geometry, and trigonometry. Lab.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Prerequisite(s): MATH 425 (may be taken concurrently) with a minimum grade of D-.
Equivalent(s): PHYS 407, PHYS 407H
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 408 - General Physics II
Credits: 0 or 4
Introductory course emphasizing waves, sound, heat, electricity and magnetism. Recommended for students specializing in science and engineering. This version is the traditional format with three lectures, one recitation (problem solving section), and one lab each week. Students in this version must also register for a particular recitation and lab. Lab.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Prerequisite(s): PHYS 407 with a minimum grade of D- and MATH 426 (may be taken concurrently) with a minimum grade of D-.
Equivalent(s): PHYS 408H, PHYS 408S
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 408H - Honors/General Physics II
Credits: 0 or 4
Introductory course emphasizing waves, sound, heat, electricity and magnetism. Recommended for students specializing in science and engineering. The honors version covers the same material as the traditional lecture course, but with three two-hour classes per week, most of which is spent working on activities in groups (rather than lecture). Students in the Honors section must be co-enrolled in MATH 426H so that strong connections can be made between math and physics. 408H students work in groups in every class meeting. Students in this version do not register for a recitation or lab, since these activities are integrated into the regular class meetings. Lab.
Co-requisite: MATH 426H
Attributes: Discovery Lab Course; Honors course; Physical Science(Discovery)
Prerequisite(s): PHYS 407H with a minimum grade of D- and MATH 425H with a minimum grade of D-.
Equivalent(s): PHYS 408, PHYS 408S
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 408S - General Physics II Studio
Credits: 4
Introductory course emphasizing waves, sound, heat, electricity and magnetism. Recommended for students specializing in science and engineering. The Studio version covers the same materials as the traditional lecture course, but with three two-hour classes per week, most of which is spent working on activities in groups (rather than lecture). Students in this version do not register for a recitation or lab since these activities are integrated into the regular class meetings. Lab.
Attributes: Discovery Lab Course; Physical Science(Discovery)
Prerequisite(s): PHYS 407 with a minimum grade of D- and MATH 426 (may be taken concurrently) with a minimum grade of D-.
Equivalent(s): PHYS 408, PHYS 408H
Mutual Exclusion: No credit for students who have taken .
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 409 - Investigating Physics
Credits: 4
Elementary physics course where students develop a conceptual understanding of topics such as the solar system, phases of the moon, seasons, electrical circuits, electromagnets, light and color, sound and simple machines. The course is based on hands-on-activities, small groups, and discussions. This course is intended for students with little or no previous experience in physics who do not intend to take any other physics course. Cannot be taken for credit if credit received for PHYS 401, 402, 407 or 408. Not open to Physics majors.
Attributes: Discovery Lab Course; Physical Science(Discovery); Inquiry (Discovery)
Equivalent(s): PHYS 401, PHYS 402, PHYS 407, PHYS 408
Grade Mode: Letter Grading

PHYS 440A - Hon/Searching for Our Place in the Universe: Foundation and Limits of Certainty in Physical Science
Credits: 4
We explore models of the universe and our place in it. We discuss the foundation of ideas about motion on Earth and in space, as well as the history of modern physics and astronomy, which have changed how we understand space and time. We consider the sources and limitations of human knowledge concerning the origin of the universe, the mystery of the origin of life and evidence that our description of reality is incomplete.
Attributes: Honors course; Physical Science(Discovery); Writing Intensive Course
Grade Mode: Letter Grading

PHYS #444B - Into the Final Frontier: America's Journey into Space
Credits: 4
One of the greatest accomplishments of the twentieth century is the human advance into space. For the first time ever, travel beyond the Earth is more than just the subject of adventurous science fiction tales - it is a reality. The purpose of this course is to trace the development of space flight from the late 1800's to the present time and to discuss the future of the United States human space flight program.
Attributes: Environment,TechSociety(Disc); Inquiry (Discovery); Writing Intensive Course
Grade Mode: Letter Grading

PHYS 501 - Peer-Led Team Learning in Physics
Credits: 1
This course provides students with their initial experience as a peer instruction leader. In this course peer leaders will deepen their knowledge of introductory physics, be introduced to pedagogical theories. Pedagogical topics covered include questioning techniques, learning theory, cooperative learning, student epistemologies, and the nature of science. Students in this course are asked to reflect on their work as peer leaders through the lens of the required readings.
Prerequisite(s): (PHYS 401 with a minimum grade of D- and PHYS 402 with a minimum grade of D-) or (PHYS 407 with a minimum grade of D- and PHYS 408 with a minimum grade of D-).
Grade Mode: Credit/Fail Grading

PHYS 505 - General Physics III
Credits: 3
Electromagnetic waves, geometrical and physical optics, relativity, atomic physics, elementary quantum mechanics, molecular physics, and nuclear physics.
Prerequisite(s): PHYS 408 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 506 - General Physics III Laboratory
Credits: 1
Structured laboratory experience in optics and modern physics. Lab.
Co-requisite: PHYS 505
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 508 - Thermodynamics and Statistical Mechanics
Credits: 4
Classical and statistical approach to thermodynamics, kinetic theory.
Prerequisite(s): PHYS 505 (may be taken concurrently) with a minimum grade of D- and (MATH 525 with a minimum grade of D- or MATH 527 with a minimum grade of D-).
Grade Mode: Letter Grading

PHYS 601 - Computational Physics Recitation I
Credits: 1
This course bridges students' computer science class and their physics classes by applying computational tools to basic physics problems. Students will write, check, and document two physics codes. This course focuses on solving differential equations. The course will support students as they work on computational assignments from their core physics courses. Corequisite: PHYS 505 or PHYS 508.
Prerequisite(s): CS 410 with a minimum grade of D- or IAM 550 with a minimum grade of D-.
Grade Mode: Credit/Fail Grading

PHYS 602 - Computational Physics Recitation II
Credits: 1
This course bridges students' computer science class and their physics classes by applying computational tools to basic physics problems. Students will write, check, and document two physics codes. This course focuses on data processing. The course will support students as they work on computational assignments from their core physics courses. Corequisite: PHYS 605 or PHYS 615.
Prerequisite(s): (CS 410 with a minimum grade of D- or IAM 550 with a minimum grade of D-) and PHYS 601 with a minimum grade of D-.
Grade Mode: Credit/Fail Grading

PHYS 605 - Experimental Physics I
Credits: 5
Circuit design with passive and active elements including transistors and operational amplifiers; electrical measurements for experimental physics; digital electronics, microprocessors, and interfacing techniques. Lab.
Prerequisite(s): PHYS 408 with a minimum grade of D- and (MATH 525 with a minimum grade of D- or MATH 527 with a minimum grade of D-).
Grade Mode: Letter Grading
Special Fee: Yes

PHYS 615 - Classical Mechanics and Mathematical Physics I
Credits: 4
Analytical treatment of classical mechanics covering the dynamics of particles and rigid bodies at an intermediate level. Advanced mathematical analysis (complex numbers, differential equations, Fourier series, multiple integrals) are reviewed or introduced as needed to analyze physical situations.
Prerequisite(s): PHYS 407 with a minimum grade of D- and (IAM 550 with a minimum grade of D- or CS 410P with a minimum grade of D-) and ((MATH 527 (may be taken concurrently) with a minimum grade of D- and MATH 528 (may be taken concurrently) with a minimum grade of D-) or (MATH 525 (may be taken concurrently) with a minimum grade of D- and MATH 526 (may be taken concurrently) with a minimum grade of D-)).
Grade Mode: Letter Grading

PHYS 616 - Classical Mechanics and Mathematical Physics II
Credits: 4
Analytical treatment of classical mechanics covering the dynamics of particles and rigid bodies, at an intermediate level. Advanced mathematical analysis (complex numbers, differential equations, Fourier series, multiple integrals) are reviewed or introduced as needed to analyze physical situations.
Prerequisite(s): PHYS 505 with a minimum grade of D- and PHYS 615 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 701 - Quantum Mechanics I
Credits: 4
Non-relativistic Schroedinger equation, the hydrogen atom, applications to atomic and nuclear structure.
Prerequisite(s): PHYS 505 with a minimum grade of D- and PHYS 615 with a minimum grade of D- and PHYS 616 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 702 - Quantum Mechanics II
Credits: 4
Non-relativistic Schroedinger equation, the hydrogen atom, applications to atomic and nuclear structure.
Prerequisite(s): PHYS 701 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 703 - Electricity and Magnetism I
Credits: 4
Foundation of electromagnetic theory; electrostatics, dielectric theory, electromagnetism, magnetic properties of matter, alternating currents, Maxwell's field theory.
Prerequisite(s): PHYS 408 with a minimum grade of D- and PHYS 615 with a minimum grade of D- and ((MATH 527 with a minimum grade of D- and MATH 528 with a minimum grade of D-) or (MATH 525 with a minimum grade of D- and MATH 526 with a minimum grade of D-)).
Grade Mode: Letter Grading

PHYS 704 - Electricity and Magnetism II
Credits: 4
Foundation of electromagnetic theory; electrostatics, dielectric theory, electromagnetism, magnetic properties of matter, alternating currents, Maxwell's field theory.
Prerequisite(s): PHYS 703 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 705 - Experimental Physics II
Credits: 4
Modern physics experiments and special project problems assigned to individual students. Lab.
Attributes: Writing Intensive Course
Prerequisite(s): PHYS 605 with a minimum grade of D- and PHYS 505 with a minimum grade of D- and (CS 410P with a minimum grade of D- or IAM 550 with a minimum grade of D-).
Grade Mode: Letter Grading

PHYS 708 - Optics
Credits: 4
Geometrical optics, electromagnetic theory of light, interference, diffraction, polarization, related phenomena and nonlinear optics. Lab.
Prerequisite(s): PHYS 505 with a minimum grade of D- and PHYS 615 with a minimum grade of D- and PHYS 616 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 710 - Astrophysics I
Credits: 4
A comprehensive review of modern astrophysics. Topics covered include the celestial sphere, celestial mechanics, the tools of the modern astronomer (including different types of telescopes for studying the electromagnetic radiation from space), stellar spectra, stellar atmospheres, stellar interiors, the formation of stars, stellar evolution, and the stellar graveyard (white dwarfs, neutron stars, and black holes).
Prerequisite(s): ((MATH 525 with a minimum grade of D- and MATH 526 with a minimum grade of D-) or (MATH 527 with a minimum grade of D- and MATH 528 with a minimum grade of D-)) and PHYS 505 with a minimum grade of D- and PHYS 506 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 711 - Astrophysics II
Credits: 4
A continuation of the comprehensive review of modern astrophysics. Topics covered include the degenerate stellar remnants (white dwarfs, neutron stars, black holes), the interstellar medium, the Milky Way Galaxy, the nature of galaxies, the evolution of galaxies, the structure of the Uni verse, active galaxies, cosmology, and the early Universe.
Prerequisite(s): PHYS 710 with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 712 - Space Plasma Physics
Credits: 4
Introduces space plasma physics, including solar physics, heliospheric physics, magnetospheric physics, and ionospheric physics. An overview of the basic phenomena and processes (e.g., particle acceleration and transport, shock formation, magnetic structures and reconnection, wave propagation, wave-particle interactions, instabilities), theoretical techniques (e.g., single-particle orbits, kinetic and fluid descriptions), and experimental techniques. (Alternate years only.)
Prerequisite(s): PHYS 408 with a minimum grade of D- and PHYS 508 with a minimum grade of D- and PHYS 616 with a minimum grade of D-.
Equivalent(s): EOS 712
Grade Mode: Letter Grading

PHYS 718 - Condensed Matter Physics
Credits: 4
Theory and experiment underlying the behavior of solids. Transport theory, surface studies, and the interaction of radiation and matter. Operation of semiconducting and superconducting devices and lasers.
Prerequisite(s): PHYS 508 with a minimum grade of D- and PHYS 701 (may be taken concurrently) with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 720 - Nuclear Physics
Credits: 4
Nuclear phenomenology, reactions, models, radiation, interaction of radiation with matter; accelerators; properties and interactions of elementary particles; symmetries and symmetry breaking; standard model.
Prerequisite(s): PHYS 702 (may be taken concurrently) with a minimum grade of D- and PHYS 703 (may be taken concurrently) with a minimum grade of D-.
Grade Mode: Letter Grading

PHYS 764 - General Relativity and Cosmology
Credits: 4
Review of special relativity, and the motivation for considering gravity in terms of curvature of space time. Introduction to Riemannian geometry, general relativity and Einstein's equations. Application of general relativity in the study of black holes, gravitational waves, cosmology, as well as recent results on inflation and quantum gravity. (Alternate years only.)
Prerequisite(s): PHYS 505 with a minimum grade of D- and PHYS 508 with a minimum grade of D- and PHYS 616 with a minimum grade of D- and (CS 410P with a minimum grade of D- or IAM 550 with a minimum grade of D-) and (MATH 645 with a minimum grade of D- or MATH 545 with a minimum grade of D- or MATH 525 with a minimum grade of D-).
Grade Mode: Letter Grading

PHYS 795 - Independent Study
Credits: 1-8
Individual project under direction of a faculty adviser.
Grade Mode: Letter Grading

PHYS 797 - Senior Design Project
Credits: 2
Four credits of this course is the required Senior Design Project for BSEP majors and fulfills their capstone requirement; the course is taken for two credits in each of the last two semesters before graduation. Students work under the direction of a faculty sponsor on the design aspect of a specific project, which might include trade studies, design reviews, cost-benefit analyses, etc. all leading to an optimal design solution. Acceptable designs can include detailed hardware aspects of a system or sub-system, numerical modeling of a system, or paper studies of a system concept. Students are required to submit a final report and to present their work at a public forum. Restricted to BSEP seniors.
Attributes: Writing Intensive Course
Repeat Rule: May be repeated for a maximum of 4 credits.
Grade Mode: Letter Grading

PHYS 798 - Senior Project
Credits: 2-4
Students complete an independent project and submit a written report. Students can choose from a range of projects, including (but not limited to)a research or numerical project, and extensive literature review on an advanced physics topic, building an apparatus, or developing a new or existing experiment in Physics 705. A student intending to take Physics 798 must arrange to have a faculty advisor for the project and should work with this advisor to develop a one-page project proposal. The student must submit this proposal to the Physics Undergraduate Curriculum Committee by the tenth week of the semester preceding the semester in which the student takes Physics 798. This course satisfies the capstone requirement in Physics.
Grade Mode: Letter Grading

PHYS 799 - Thesis
Credits: 4
Students work under the direction of a faculty sponsor to plan and carry out independent research resulting in a written thesis. Required for honors-in-major.
Attributes: Writing Intensive Course
Prerequisite(s): PHYS 795 with a minimum grade of D- or INCO 790 with a minimum grade of D-.
Repeat Rule: May be repeated for a maximum of 8 credits.
Grade Mode: Letter Grading

Faculty

https://ceps.unh.edu/physics/faculty-staff-directory