

PHYSICS

Program Website: Physics – Hiram College (<https://www.hiram.edu/academics/undergraduate-studies/undergraduate-programs/physics/>)

Introduction

The physics major is intended for students who are interested in the connection between basic physics principles and how the universe works. It provides them with a solid foundation for careers in business and education and for research and development positions in industry and government. It also prepares them for graduate work in physics or engineering, as well as being an unusual and attractive preparation for medical school or law school.

The courses taken toward the major in physics have a strong component in basic physics; in addition, the upper-level courses explore various core areas and specialties within physics. Emphasis in the program is placed on learning physics and its applications through critical thinking, problem solving, and laboratory experience. Students are encouraged to do independent study and research in areas of their interest. Sometimes advanced courses may be offered, depending on faculty and student interests and student needs. These courses may include topics such as mathematical and computational methods of physics, nuclear physics, astrophysics, and solid state physics. Students interested in majoring in physics should consult with a member of the physics program as early as possible to ensure the proper sequence of courses. Check out our web page at: <http://www.hiram.edu/physics> (<http://www.hiram.edu/physics/>).

Another opportunity within the physics program (as well as chemistry and computer science) is for a dual degree in engineering to go along with the degree from Hiram. A student can attend Hiram College for three years, then if the requirements are met, transfer to Case Western Reserve University in Cleveland, OH or Washington University in St. Louis for two more years. At the end of the five years, that student would then graduate with a bachelor's degree in physics from Hiram College and a bachelor's degree in engineering from CWRU or Washington University. Please check out the engineering catalog page for further information or go to the web site at <http://www.hiram.edu/academics/majors-minors/engineering/>

Requirements for Honors

Honors in physics are awarded on the basis of Hiram College's program honors requirements (overall GPA of at least 2.8, program GPA of 3.6, and the sum of these being at least 6.8) plus submission of an exemplary written thesis based on the senior seminar project.

Special Opportunities

Physics faculty have research interests in statistical mechanics, condensed matter physics, and computational physics and welcome student involvement. The physics program has research-quality equipment and facilities available for student projects and research including: lasers, oscilloscopes, and multi-channel analyzers; radiation-detection equipment of all types; a neutron flux tank; low temperature Dewars; an ultra-high vacuum chamber; X-ray facilities; and a holography lab and darkroom. In addition, a complete machine shop and electronic facilities make it possible to modify and construct equipment. Computers are available for equipment interfacing and data acquisition. The program also has a computational physics laboratory that includes several high-end Unix workstations and a Beowulf cluster for numerically intensive computing.

Faculty

Daniel Gavazzi, (2022) Visiting Instructor of Physics and Computer Science

B.A., Hiram College;
M.A., Kent State University
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Mark P Taylor, (2001) Associate Professor of Physics; Chair; Liaison, Dual Degree Engineering Program

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Course Descriptions

PHYS 11300: PRINCIPLES PHYSICS I-W/LAB:SM: 4 Hour(s)

PRINCIPLES OF PHYSICS I-W/LAB:SM ~ An introduction to the basic concepts of physics including mechanics, wave motion, temperature, heat, and thermodynamics. The course is designed for the person with no physics background; however, the ability to use algebra and trigonometry is assumed. Students who have had a rigorous high-school physics course and have met the calculus prerequisite should take PHYS 21300. Student must register for a PHYS 00100 lab. Offered every fall 12-week. Prerequisite: high-school algebra and trigonometry. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.

Core: Experimental Scientific Method

PHYS 11400: PRINCIPLES PHYSICS II-W/LAB:SM: 4 Hour(s)

PRINCIPLES OF PHYSICS II-W/LAB:SM ~ A continuation of PHYS 11300. Topics included are electrical, magnetic, and optical phenomena with emphasis on their use in modern technology followed by a qualitative and quantitative coverage of unique developments in the 20th century. These developments include Einstein's special theory of relativity, quantum mechanics, atomic and nuclear behavior and structure, and elementary particle theory. Laboratory work includes study of simple electrical circuits, measurement of electron charge and mass, and investigation of radioactivity. Offered every spring 12-week. Student must register for a PHYS 00100 lab.

Prerequisite: PHYS 11300 (may be taken concurrently) or PHYS 21300 (may be taken concurrently)

Core: Experimental Scientific Method

PHYS 18000: WKSP: 1 Hour(s)

WORKSHOP ~ This workshop will provide the opportunity for students to examine a special topic in Physics. Through readings, discussions and written assignments there will be opportunities to evaluate the topic at issue. Workshops may be taken Pass/No Credit only. Students may take no more than nine workshops for credit toward graduation. Workshops can be used as elective credit only.

PHYS 20200: INTRO TO ASTRONOMY-W/LAB:SM: 4 Hour(s)

INTRODUCTION TO ASTRONOMY:SM ~ An introduction to modern astronomy. A survey of the universe as we understand it today, including how we know, provides the framework to explain the workings of science and the nature of scientific law. Students must also register for a PHYS 20200 lab The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.

Core: Experimental Scientific Method

PHYS 21300: FUNMNTLS OF PHYSICS-W/LAB I:SM: 4 Hour(s)

FUNDAMENTALS OF PHYSICS I-W/LAB:SM ~ Fundamental concepts of physics with emphasis on acquiring analytical skill in the solution of problems. Fundamental principles and experimental laws of mechanics, wave motion, sound, heat, and thermodynamics will be covered. This course is for students, concentrating in science, who desire a thorough understanding of the fundamentals of physics. Students must register for a PHYS 00100 lab. Offered every fall 12-week.

Prerequisite: MATH 19800 (may be taken concurrently)

Core: Experimental Scientific Method

PHYS 21400: FUNMNTL OF PHYSICS-W/LAB II:SM: 4 Hour(s)

FUNDAMENTALS OF PHYSICS II-W/LAB:SM ~ A continuation of PHYS 21300. Fundamental principles and experimental laws of electricity, magnetism, and optics and an introduction to quantum mechanics will be covered. Students must also register for PHYS 00100 lab. Offered every spring 12-week.

Prerequisite: PHYS 21300 (may be taken concurrently) and MATH 19900 (may be taken concurrently)

Core: Experimental Scientific Method

PHYS 22500: INTRO ELECTRONICS-W/LAB: 4 Hour(s)

INTRODUCTORY ELECTRONICS-W/LAB ~ An introduction to the principles of electronics and the uses of electronic components. The laboratory will investigate the fundamentals of linear and digital circuits while using basic laboratory instruments such as oscilloscopes, waveform generators, and digital multimeters. Topics will include basic circuit theory, passive devices, junction and field effect transistors, operational amplifiers, digital logic, integrated circuit chips and optical solid-state devices. This course is designed for physics and chemistry majors and entails a considerable amount of problem solving. While not required, a familiarity with calculus would be helpful. Student must also register for a PHYS 22500 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Also listed as CHEM 22500.

Prerequisite: PHYS 11400 or PHYS 21400

PHYS 28000: SEM:: 1-4 Hour(s)

SEMINAR ~

PHYS 28100: INDEPENDENT STUDY: 1-4 Hour(s)

INDEPENDENT STUDY ~

PHYS 29800: FIELD EXPERIENCE: 1-4 Hour(s)

FIELD EXPERIENCE ~

PHYS 32000: FUNMNTLS OF MRDN PHYSICS-W/LAB: 4 Hour(s)

FUNDAMENTALS OF MODERN PHYSICS-W/LAB ~ An experimental and theoretical development of fundamental concepts of modern physics, including the special theory of relativity, quantum mechanics, atomic and nuclear structure, and elementary particles. Offered every fall 12-week. Student must also register for a PHYS 32000 lab. Must meet prerequisite or instructor permission required.

Prerequisite: PHYS 21400

Corequisite: MATH 20000

PHYS 33000: MECHANICS: 3 Hour(s)

MECHANICS ~ A course intended to develop an understanding of the principles of mechanics introduced in PHYS 21300 and PHYS 21400 and to treat specific problems important in physics and engineering. The topics to be covered will include particle motion in one, two, and three dimensions; the motion of systems of particles; the motion of rigid bodies; rotation, gravitation, and moving frames of reference; Lagrangian and Hamiltonian methods. Offered fall 3-week, alternate years.

Prerequisite: PHYS 32000

PHYS 35000: QUANTUM PHYSICS: 4 Hour(s)

QUANTUM PHYSICS ~ A theoretical course in quantum mechanics which significantly develops the basic concepts introduced by PHYS 32000.

Topics covered will include: A review of wave mechanics; Fundamental postulates state space, Dirac notation, operators, and eigenvectors; Commutation relations, observables, and time evolution; Three-dimensional systems and angular momentum; Spin and identical particles; Perturbation theory and other approximation methods; Measurement theory and "quantum reality". Offered spring 12-week, alternate years. MATH 24300 is recommended.

Prerequisite: PHYS 32000 (may be taken concurrently)

PHYS 36000: ELECTROMAGNETIC THEORY: 4 Hour(s)

ELECTROMAGNETIC THEORY ~ A theoretical course in classical electromagnetic theory. The course is intended to develop an understanding of electromagnetic theory that was introduced in PHYS 21400 and to study specific problems in the classical theory concerning charged objects. The topics covered will include a review of vector calculus, electrostatics, electrical potentials, magnetostatics, electrodynamics, and an introduction to electromagnetic waves. Offered spring 12-week, alternate years.

Prerequisite: PHYS 32000

PHYS 38000: SEM:: 1-4 Hour(s)

SEMINAR ~

PHYS 38100: SPC TPC:: 1-4 Hour(s)

SPECIAL TOPICS ~

PHYS 44000: PHYSICS ADVANCED LABORATORY: 3 Hour(s)

PHYSICS ADVANCED LABORATORY ~ In this course students carry out a series of in-depth experiments in the areas of atomic physics, optics, solid state physics, and nuclear physics. Specific experiments include nuclear magnetic resonance, optical interferometry, X-ray scattering, and gamma-ray spectroscopy. A complete understanding of each experiment requires a synthesis of knowledge from several different fields of physics. The course stresses basic experimental techniques and data and uncertainty analysis along with oral and written presentation of experimental results. (Offered spring 3-week, alternate years). Prerequisites: PHYS 32000 and one other upper-level physics course.

Prerequisite: PHYS 32000 (may be taken concurrently)

PHYS 48000: SENIOR SEMINAR: 1 Hour(s)

SENIOR SEMINAR ~ Students determine a research topic in which they are interested and have it approved by the physics faculty early in their senior year. The senior seminar may be based on research done during a summer research experience or on work done at Hiram. Although original research is preferred, a library research project using primary sources is acceptable. Successful fulfillment of this requirement will include a 30-minute public presentation and a written thesis.

PHYS 48100: INDEPENDENT RESEARCH: 1-4 Hour(s)

INDEPENDENT RESEARCH ~

PHYS 49800: INTERNSHIP: 4 Hour(s)

INTERNSHIP ~

Academic Offerings

- Physics Major (<https://catalog.hiram.edu/undergraduate/academic-programs/physics/physics-major/>)
- Physics Minor (<https://catalog.hiram.edu/undergraduate/academic-programs/physics/physics-minor/>)