DEPARTMENT OF PHYSICS

COLLEGE OF ARTS AND SCIENCES

Faculty

William Nettles (2006). Professor of Physics, Department Chair, and Associate Dean of the College of Arts and Sciences. B.S., Mississippi College; M.S., and Ph.D., Vanderbilt University.

Ildefonso Guilaran(2008). Associate Professor of Physics. B.S., Western Kentucky University; M.S. and Ph.D., Florida State University.

Geoffrey Poore(2010). Assistant Professor of Physics. B.A., Wheaton College; M.S. and Ph.D., University of Illinois.

David A. Ward (1992, 1999). Professor of Physics, B.S. and M.A., University of South Florida; Ph.D., North Carolina State University.

Curriculum

The programs offered by the Department of Physics are designed to help students understand the physical world by examining the laws which describe the interactions throughout the universe, the methods by which the cosmos can be studied, and the relationship of physics to other aspects of human experience. The department offers courses that effectively serve all students within the institution, recognizing that each student's needs and career goals may be different. The curriculum is designed to provide content of the appropriate level and diversity for students classified as physics majors/minors, non-science majors, engineers, pre-professionals, and those preparing for a teaching career in secondary school. The faculty endeavor to create an atmosphere in which students are challenged to acquire problem-solving skills using advanced mathematics and modern methods in science. Students are encouraged to develop in-depth analytical skills and an attitude of scientific curiosity

Assessment of Major

All Physics majors are required to take a research class, PHY 424, and a seminar class, PHY 498, in which presentations are made and students are questioned orally. Seniors must also take the Major Field Examination in physics and if seeking teacher licensure, complete the required education tests such as PRAXIS.

Student Organizations

The Society of Physics Students (SPS) stimulates an awareness of physics and the related sciences, and acquaints students with professional opportunities within the discipline. The organization promotes professionalism and pride in the physical sciences and assists students in studying, preparing, and presenting technical material. Membership is open to any student interested in physics.

Student Awards

The Physics Research Award is given by the faculty of the Department of Physics to the student who presents the best research paper of the year. The research must have been an original work and must be presented at a state, regional, or national professional meeting prior to the graduation.

The Freshman Physics Award is given to the freshman student completing PHY 231-232 who has shown outstanding scholastic achievement, Christian service, and school spirit.

The Kyle L. Hathcox Memorial Physics Award is given annually to the junior or senior student majoring or minoring in Physics. In addition to meeting specific academic criteria, the student will demonstrate excellence and decorum consistent with the faith heritage of Union University and consistent with the legacy of Dr. Hathcox, whose priorities have been aptly described as “faith, family, and physics.”

Course Offerings in Physics (PHY)

( ) Hours Credit; F-Fall; W-Winter; S-Spring; Su-Summer

111. Principles of the Physical Sciences (4) F, W, S
Introduction to physics and chemistry for non-science majors including their historical, philosophical, and social significance. Exercises are indicative of various scientific methods. Knowledge of basic algebra is assumed. Science credit will not be given after completion of a course in either CHE or PHY. Three lectures, one 2-hour laboratory/week.

112. Earth and Space Science (4) F, W, Su–As Needed
Reciprocal credit: GEO 112.
Earth science and astronomy: their nature, history, divisions, and relation to other sciences. The physical laws of nature will be examined as they apply to physical geography, meteorology, and astronomy. Three lectures, one 2-hour laboratory/week.

213-4. Introduction to Physics (4) 213—F, Su; 214—S, Su
Prerequisite: MAT 111& 112, or 116.
The first semester involves the study of classical mechanics, wave motion, fluid flow, sound, temperature, and heat. The second involves the study of electricity, magnetism, light, optics, and modern physics. Cannot be used as a PHY Elective toward majors/minors. Three lectures, one 3-hour laboratory/week.

231-2. University Physics I, II with Calculus (5)
231—F; 232—F, S
Prerequisite to 231: MAT 211. Pre- or Corequisite to 232: MAT 212.
The first semester involves the study of classical mechanics, wave motion, fluid flow and sound. The second involves the study of temperature and heat, electricity, magnetism, light and optics. Four lectures, one laboratory/week.

313. Intermediate Mechanics (3)
Prerequisite: PHY 232 & MAT 212.
Introduction to rectilinear and curvilinear dynamics of particles and rigid bodies; both Lagrangian and Hamiltonian formulations of mechanics will be developed and applied.

314. Intermediate Electricity and Magnetism (3)
Prerequisites: MAT 212 & PHY 232.
Electric and magnetic fields both in media and a vacuum. Maxwell's equations are used to determine electromagnetic fields produced by a variety of charge and current distributions.

325. Thermodynamics & Statistical Mechanics (3)
Prerequisites: MAT 212 & PHY 232.
An intermediate survey of heat and thermodynamics including the concepts of temperature and heat, the laws of thermodynamics, thermodynamics potentials, the Maxwell relations and statistical methods applied to the thermodynamics of various states of matter, including gases, liquids, and quantum fluids.

360. Mathematical Methods in Physics (3)
Prerequisites: MAT 213, PHY 232.
Special differential equations, complex number analysis, linear algebra, group therapy and Fourier analysis applied to advanced topics in physics.

400. Optics and Lasers (3) S
Prerequisites: MAT 213, PHY 232.
Analyzes the behavior of electromagnetic radiation, emphasizing geometrical optics and instrumentation. The role of optics in spectroscopic measurements will be highlighted by discussing polarization and diffraction. Includes an introduction to laser physics and operations using systems, including excimer and neodymium-YAG lasers.

410. Nuclear Physics (3)
Prerequisites: MAT 213 and PHY 311.
A study of the atomic nucleus, including its constituents, interactions and energies. Radiative processes, angular momentum, and practical applications such as astrophysics, medical physics, energy production, and environmental physics.

416. Physical Principles of Solid State Devices (3)
Prerequisites: PHY 262 and 311. Reciprocal credit: EGR 416. See EGR 416 for description.

420. Quantum Mechanics (3)
Prerequisites: PHY 311 & MAT 314.
Fundamental principles of quantum mechanics, methods of calculation, and solutions to Schrodinger's equation. Applications to atomic, molecular, and nuclear physics with an introduction to operator notation. Three lecture hours/week.

424-425. Physics Research (1-3) F, S
Prerequisite: PHY 311.
Application of a simple piece of original work to include a literature search and summary paper on a topic of current interest in physics. Under faculty supervision, this work may be done off site at a national laboratory or comparable research facility.

430. Experimental Physics Laboratory (3)
Prerequisites: PHY 311 & MAT 213.
Modern experimentation, research, data acquisition and analysis. The theory, practice and reporting of research in a scientific format are demonstrated through experiments in atomic, nuclear, solid state, thermodynamics, and optics. One lecture, 4 lab hours/week.

498. Seminar (1-3) S
Prerequisite: 20 hours of physics and junior/senior standing.
Skills in scientific and technical presentations, written and oral, will be polished. To be used at the discretion of the department for majors/minors only.

179-279-379-479. External Domestic Study Programs (1-3) As Needed
All courses and their applications must be defined and approved prior to registering.

180-280-380-480. Study Abroad Programs (1-4) As Needed
All courses and their application must be defined and approved prior to travel.

195-6-7. Special Studies (1-4) On Demand
295-6-7. Special Studies (1-4) On Demand
Lower-level group studies which do not appear in the regular departmental offerings.

395-6-7. Special Studies (1-4) On Demand
Upper-level group studies which do not appear in the regular departmental offerings.

495-6-7. Independent Study (1-4) On Demand
Individual study under the guidance of a faculty member(s).

498-9. Seminar (1-3) As Needed
To be used at the discretion of the department.