

Physics (PHYS)

Chairperson: Brian Bennett, D.Phil.

Department of Physics website (<http://www.marquette.edu/physics>)

Marquette University currently does not offer a graduate degree program in physics. However, certain upper division undergraduate courses in the Department of Physics have been approved for graduate credit and may be taken, as appropriate, by graduate students in other graduate programs.

Courses

PHYS 5012. Quantum Mechanics. 3 cr. hrs.

Quantum states, state vectors, observables and operators. The formal structure of quantum mechanics. Time evolution of the state vector. The Hamiltonian. Position and momentum representations, and the wave function. One-dimensional wave mechanics and the harmonic oscillator. Three-dimensional wave mechanics. Symmetry, angular momentum, and the hydrogen atom. Fermions, and bosons. Perturbation methods.

PHYS 5024. Modern Optics. 3 cr. hrs.

Geometric optics, classical wave theory of optics, interference, diffraction, polarization, electromagnetic theory of light, interaction of light and matter, lasers and coherence.

PHYS 5031. Electricity and Magnetism 1. 3 cr. hrs.

Electrostatics: Coulomb's law and Gauss' law. The electric field in dielectric materials. Microscopic theory of Ohm's law and steady state currents. The magnetic field, Biot-Savart law, Ampere's law, the vector potential. Magnetic materials. Electromagnetic induction, Faraday's law. Maxwell's equations and electromagnetic waves.

PHYS 5032. Electricity and Magnetism 2. 3 cr. hrs.

Boundary value problems: The solution of electrostatic and magnetostatic problems in continuous media. Microscopic theories of the dielectric and magnetic properties of materials. Electromagnetic waves in bounded regions. Reflection, refraction and dispersion. Radiation from accelerated charges. Antennae. Electrodynamics and the theory of special relativity.

PHYS 5046. The Physical Basis of the Biological Environment. 3 cr. hrs.

The molecular processes of life occur in a complex aqueous molecular environment. Biological molecules and their environments are governed by the principles of physics. Presents and explains physical techniques and models based on mechanics, thermodynamics, and electricity and magnetism. Shows how these apply to help characterize and understand the environments in which cells and biological molecules operate, while also helping to explain cellular and physiological processes.

PHYS 5062. Introduction to Thermodynamics. 3 cr. hrs.

Fundamental concepts of thermodynamics: temperature, internal energy, entropy and thermodynamic potentials. Laws of thermodynamics, their consequences and applications. Introduction to statistical thermodynamics.

PHYS 5065. Experimental Methods in Molecular Biophysics. 3 cr. hrs.

An introduction to the field of biological physics which develops the science and illustrates the applications of the techniques of X-ray diffraction and spin resonance to problems of biological interest: protein structural dynamics, ion channels and transport through cell membranes.

PHYS 5071. Atomic Physics. 3 cr. hrs.

Quantum mechanics of one and many electron atoms. Spin, orbital, and total angular momentum. Atoms in electric and magnetic fields, the Stark effect and the Zeeman effect. Atomic transitions, symmetry and selection rules. The periodic table and shell structure. Modern spectroscopy.

PHYS 5072. Introduction to Nuclear and Elementary Particle Physics. 3 cr. hrs.

Experimental methods in nuclear and particle physics. Theories of nuclear structure, radioactivity, decay schemes, fission and fusion models, conservation laws. Elementary particle classifications and the Standard Model.

PHYS 5075. Introduction to Solid State Physics. 3 cr. hrs.

Crystal structure of solids, the reciprocal lattice and diffraction. Lattice vibrations and thermal properties. Electrons in metals, band structure and semiconductors. The Fermi surface. Dielectric and magnetic properties of solids. Superconductivity.

PHYS 5931. Topics in Contemporary Physics. 3 cr. hrs.

Topics drawn from areas of current interest, such as: astrophysics, atmospheric physics, condensed matter physics or particle physics.