Department of Physics

Velda Goldberg, *Chair and Professor*
Michael Kaplan, *Professor*
Patrick Johnson, *Assistant Professor*
Matthew Traum, *Lecturer*
Joseph Genevich, *Laboratory Technician*
Joanne Saro, *Administrative Assistant*

Physics helps one understand the basic, universal laws of the natural world and appreciate how this knowledge is used to design diverse devices that have tremendous implications for our lives, such as pacemakers, artificial limbs, integrated circuits, or rocket engines.

Physics also enhances preparation for careers in medicine, health sciences, industry, and education. Courses emphasize the applications of physics and provide important problem solving skills as well as laboratory and computer-related experience.

Major in Physics

The physics major focuses on the theoretical framework of the discipline, emphasizes student research, and highlights the properties and structure of materials.

Requirements: Physics majors take the following courses:

PHYS 112	Fundamentals of Physics I
PHYS 113	Fundamentals of Physics II
PHYS 120	Materials: Properties
or PHYS 121	Materials: Structure
PHYS 201	Wave Phenomena and Introduction to Modern Physics
PHYS 300	Mechanics
PHYS 305	Electricity and Magnetism
PHYS 332	Quantum Mechanics and Molecular Structure
PHYS 331	Thermodynamics and Kinetics
PHYS 350	Independent Learning (8 credits)

Choose one of the following courses:

PHYS 120	Materials: Properties
PHYS 121	Materials: Structure
PHYS 210	Imaging of Materials
PHYS 220	Materials Modeling
PHYS 310	Materials Research Methods I
PHYS 311	Materials Research Methods II
PHYS 320	Advanced Instrumentation for Materials

Prerequisites and Other Required Courses:

MATH 120	Calculus I
MATH 121	Calculus II
MATH 220	Multivariable Calculus
CHEM 111	Introductory Chemistry: Inorganic
or CHEM 113	Principles of Chemistry
CHEM 112	Introductory Chemistry: Organic
or CHEM 114	Organic Chemistry
CHEM 226	Quantitative Analysis

An additional upper-level mathematics or computer science course is also highly recommended.

Minor in Physics of Materials

A minor in physics of materials exposes students to some of the key topics in materials science and provides an opportunity to participate in materials research and use advanced instrumentation. The experience and knowledge gained are particularly relevant because technological advances in all areas, from growing artificial skin to developing faster computers, are critically dependent on innovations in materials research. This minor is particularly appropriate for biology, chemistry, or biochemistry majors or premedical (veterinary or dental) students especially those interested in the high-tech industry or medical research. The minor may also be attractive to anyone with an interest in science and/or problem solving and laboratory skills.

Requirements: 20 credits chosen as follows:

PHYS 112	Fundamentals of Physics I

PHYS 113	Fundamentals of Physics II
PHYS 120	Materials: Properties
or PHYS 121	Materials: Structure
PHYS 201	Wave Phenomena and Introduction to Modern Physics

Chose six credits from the following:

PHYS 120	Materials: Properties (2 credits)
PHYS 121	Materials: Structure (2 credits)
PHYS 210	Imaging of Materials (2 credits)
PHYS 220	Materials Modeling (2 credits)
PHYS 300	Mechanics
PHYS 305	Electricity and Magnetism
PHYS 310	Material Research Methods I
PHYS 311	Materials Research Methods II
PHYS 320	Advanced Instrumentation for Materials
PHYS 331	Thermodynamics and Kinetics
PHYS 332	Quantum Mechanics and Molecular Structure

COURSES

PHYS/BIOL 103 Great Discoveries in Science (M4) (F-1,2)

4 sem. hrs.

Focuses on breakthrough ideas concerning the universal laws of nature, the origin and composition of the universe, the nature of matter, and the origin and evolution of life. Encourages learning through inquiry and cooperative strategies to foster an appreciation of the processes, accomplishments, and limitations of science. Weekly laboratory. Designed for non-majors. Johnson, Chow.

PHYS 105 Science and Technology in the Everyday World: The Way Things Work (M4) (S-1,2)

4 sem. hrs.

Traces the development of technology, provides insight into the fundamentals of modern science and technology, emphasizes the synergy between the two, and provides practical experience in dealing with real systems and devices found in daily life. Weekly laboratory. Designed for non-majors. Goldberg.

PHYS 110 Introductory Physics I (M4) (F-1,2)
PHYS 111 Introductory Physics II (S-1,2)

4 or 8 sem. hrs. Prereq.: Secondary school algebra. (PHYS 110 is prereq. to PHYS 111.)

Teaches the fundamentals of physics for students with preparation in algebra and trigonometry. Topics drawn from mechanics, electricity and magnetism, heat, waves, sound, optics, and modern physics. Weekly three-hour laboratory and one-hour interactive problem-solving session. Johnson.

PHYS 112 Fundamentals of Physics I (M4) (F-1,2)
PHYS 113 Fundamentals of Physics II (S-1,2)

4 or 8 sem. hrs. (PHYS 112 is prereq. to PHYS 113.)

Concentrates on the subjects of mechanics, electricity, and magnetism and on the concepts of particle and field, motion, mass, force, energy, and momentum. Additional material drawn from kinetic theory, heat, and thermodynamics. First course in physics for science majors. Weekly three-hour laboratory and one-hour interactive problem-solving session. Goldberg, Kaplan.

PHYS 120 Materials: Properties (S-2)

2 sem. hrs.

Largely through experimentation, examines some of the ways in which one characterizes and/or measures a materials' mechanical, electrical, thermal, magnetic, optical, and electrical properties. Also investigates the way in which processing conditions may influence properties and how this information can be used to construct useful devices. Johnson.

PHYS 121 Materials: Structure (S-1)

2 sem. hrs.

Focuses on the theories that explain mechanical, electrical, thermal, magnetic, optical, and electrical properties. Examples include theories related to atomic structure and interatomic bonding, imperfections in solids, diffusion, stress/strain and elastic properties, phase transformations,

electrical conductivity, magnetic interactions, and optical absorption and luminescence. Introduces X-ray diffraction and molecular modeling through laboratory experiments and simulations. Soltzberg.

PHYS 201 Wave Phenomena and Introductory Modern Physics (F-1,2)

4 sem. hrs. Prereq.: PHYS 112/113.

Focuses on wave properties common to both optics and acoustics and then extends these topics to introduce key ideas in modern physics. Rounds out a general background in physics and is recommended, along with PHYS 112/113, for preparation for the MCAT exam. Kaplan.

PHYS 210 Imaging of Materials (F-1,2)

2 sem. hrs.

Intended for science majors or physics of materials minors who would like to learn to use an electron microscope and an atomic force microscope to study surface morphology. (Requests to use these microscopes for independent research may be made to the Department of Physics after successful completion of this course. Open to non-science majors.) Goldberg.

PHYS/CHEM 220 Materials Modeling (F-2)

2 sem. hrs.

Provides a hands-on introduction to the use of computer methods for discovery and assessment of novel materials. Teaches the use of a variety of molecular and materials modeling software and presents the principles, benefits, and pitfalls associated with this approach to the study of materials. Emphasizes modeling projects and genuine research applications of computer modeling. Soltzberg.

PHYS 226 Electrical, Magnetic, and Elastic Properties of Materials (S-1)

2 sem. hrs. Prereq. PHYS 112/113.

Introduces the microscopic physics of the properties of materials. Basis for discussion includes fundamental concepts of the localized and delocalized (collectivized) electrons. Discusses traditional solid state topics as well as modern phenomena such as high temperature superconductivity, ferroelasticity, and colossal magnetoresistance. Kaplan.

PHYS 300 Mechanics (S-2)

4 sem.hrs. Prereq.: PHYS 201 and MATH 220.

Examines the fundamental principles of Newtonian mechanics; the conservation laws, the dynamics of a particle, including oscillations and central force motion; and the dynamics of a system of particles. Includes laboratory work. Goldberg.

PHYS 305 Electricity and Magnetism (S-1)

4 sem. hrs. Prereq.: PHYS 201 and MATH 220.

Examines the fundamental principles of electromagnetic theory through the introduction of Maxwell's equations and discusses electrical and magnetic fields in matter. Stresses applications to contemporary devices. Includes laboratory work. Johnson.

PHYS 310 Materials Research Methods I (F-1,2)

2 sem. hrs.

Offers a clear understanding of and experience with particular instruments or techniques (such as high vacuum systems, thin film deposition, spin-coating, photolithography, self-assembly, and micropatterning) used in the preparation of thin films or selectively activated surfaces. Emphasizes the influence of processing conditions on material properties. Work with faculty on ongoing research projects and present results in a paper or an oral presentation to physics and chemistry faculty. Goldberg, Gurney.

PHYS 311 Materials Research Methods II (S-1,2)

2 sem. hrs.

Offers a clear understanding of and experience with particular instruments or techniques (such as infrared, visible, and ultraviolet spectroscopy, or light scattering analysis) used to probe the internal structure of materials, including "soft" materials. Course includes the preparation of nanoparticles and colloidal dispersions. Emphasizes the influence of processing conditions. Work with faculty on on-going research projects and present results in a paper or an oral presentation to physics and chemistry faculty. Johnson, Kaplan.

F = Fall
S = Spring
U = Summer
STC = Short-Term Course
1 = Academic Year 2006-2007
2 = Academic Year 2007-2008
M = Mode
***** = Schedule t.b.a.

PHYS 320 Advanced Instrumentation for Materials (U-1,2)

2 sem. hrs. Prereq.: Permission of department

Offered at Cornell University and taught jointly by Simmons and Cornell faculty. Topics based on the particular interests of the class. Teaches sample preparation and the use of sophisticated instrumentation and equipment in Cornell's Center for Materials Research. May include, for example, learning to use a transmission electron microscope (TEM), scanning transmission microscope (STEM), xXray diffractometer, or ion beam. Staff.

PHYS/CHEM 331 Thermodynamics and Kinetics (F-1,2)

4 sem. hrs. Prereq.: CHEM 226 and PHYS 113.

See description under the Chemistry Department.

PHYS/CHEM 332 Quantum Mechanics and Molecular Structure (S-1,2)

4 sem. hrs. Prereq.: CHEM 226 and PHYS 113

See description under the Chemistry Department.

PHYS 350 Independent Learning (F-1,2; S-1,2)

4 or 8 sem. hrs.

Usually taken for two semesters (eight semester hours) but may be elected for one semester. Individual laboratory work on a research problem. Includes a thesis and a final oral presentation. Staff.

PHYS 370 Internship (F-1,2; S-1,2)

4 or 8 sem. hrs.

Provides a supervised professional experience off campus. Placement must be approved by the department. Includes a final oral presentation. Staff.

Department of Political Science and International Relations

POLITICAL SCIENCE

Walter C. Carrington, *Joan M. and James P. Warburg Professor of International Relations [2006–2007]*
Cheryl Welch, *Chair and Professor*
Kirk Beattie, *Professor*
*Zachary Abuza, *Associate Professor*
Leanne Doherty, *Assistant Professor*
Catherine Paden, *Assistant Professor*
Ausra Park, *Assistant Professor*
Maria Callejas, *Administrative Assistant*
**On leave academic year 2006–2007.*

The field of political science is divided into four subfields: American politics, comparative politics, international politics, and political theory. Collectively, courses in these areas introduce students to the study of the institutions of government, the processes of decision-making (domestic and international), the content of these decisions (public policy), and their impact on society. The field of political science is also concerned with questions of how governments should be constituted and how politics should be carried out.

The study of political science has traditionally provided a solid foundation for careers in government (national, state, and local), diplomacy, law, and business, as well as in teaching and journalism. For this reason, students often choose to combine a major in political science with one of a wide variety of other majors, such as communications, economics, education, English, history, management, psychology, sociology, or international relations.

The curriculum in the Department of Political Science consists of four introductory courses, a wide variety of topics courses, and an advanced seminar. Students in the department are