The Department of Physics offers courses to meet a broad spectrum of student needs. The Standard Physics concentration (I) provides a curriculum based in the traditional areas of theoretical and experimental physics. The Applied Computational Physics concentration (II) provides a hands-on curriculum in computational and experimental physics with an emphasis on applications in modern applied physics. In both concentrations student participation in faculty research is an important component of the program that prepares students for independent work in graduate school or industry. Both concentrations also prepare students for graduate study, either in physics or in applied sciences such as optics, photonics, scientific computing, engineering or computer science.

The Physics Department also offers a concentration in Engineering Physics (III). In this concentration, students take courses in physics at DePaul and engineering courses at another university, leading to degrees in both Physics and Engineering. Through a joint program with the Illinois Institute of Technology, students can complete a five-year dual-degree program while remaining full-time DePaul students. Additionally, the Department administers a Pre-engineering program that provides students with the scientific basis to successfully complete an engineering program at another institution.

Finally, the Department of Physics offers a less mathematical curriculum for students who require familiarity with the concepts, methodology, and instrumentation of physics as part of their preparation for careers in fields such as health, law, journalism, etc. A program in secondary-teacher education is also available.

**Faculty**

**JOHN R. THOMPSON, PH.D.**, Associate Professor and Chair  
Georgia Institute of Technology  
**ANTHONY F. BEHOF, PH.D.**, Associate Professor  
University of Notre Dame  
**MARY L. BOAS, PH.D.**, Professor Emeritus  
Massachusetts Institute of Technology  
**ZUHAIR M. EL SAFFAR, PH.D.**, Professor Emeritus  
University of Wales, Great Britain  
**SUSAN M. FISCHER, PH.D.**, Assistant Professor  
University of Notre Dame  
**CHRISTOPHER G. GOEDDE, PH.D.**, Assistant Professor  
University of California, Berkeley  
**ROSS A. HYMAN, PH.D.**, Assistant Professor  
Indiana University  
**GERARD P. LIETZ, PH.D.**, Associate Professor  
University of Notre Dame  
**JOHN W. MILTON, C.S.V., M.S.**, Instructor  
Saint Louis University  
**JESÚS PANDO, PH.D.**, Assistant Professor  
University of Arizona  
**EDWIN J. SCHILLINGER, PH.D.**, Professor Emeritus  
University of Notre Dame  
**THOMAS G. STINCHCOMB, PH.D.**, Professor Emeritus  
University of Chicago  
**DONALD O. VAN OSTENBURG, PH.D.**, Professor Emeritus  
Michigan State University
BACHELOR OF SCIENCE
LIBERAL STUDIES PROGRAM

In addition to the 28 quarter hours required in the liberal studies core, students are required to complete 48 quarter hours distributed through five learning domains as part of their Bachelor of Science degree in physics. The number and distribution of courses in each of the areas are as follows:

Core: 28 quarter hours required
First Year Program: (16 quarter hours required) Discover Chicago or Explore Chicago, Focal Point Seminar, and Composition and Rhetoric I and II.
Sophomore Seminar: (4 quarter hours required) Sophomore Seminar on Multiculturalism in the United States
Junior Year Experiential Learning: (4 quarter hours required) If your junior year experiential learning requirement also fulfills a major field requirement, you may substitute a liberal studies domain elective (from outside your major field area) or the third course in the modern language option for this requirement.
Senior Capstone: (4 quarter hours required) Physics requires students majoring in Physics to complete the senior capstone in Physics, unless you are a double major and/or in the Honors program. If you are a double major and/or in the Honors Program you must follow the capstone guidelines for that area if the capstone is required. If the capstone is optional in the other areas, you can elect which capstone to complete.
Arts and Literature: 12 quarter hours required. At most 2 courses from the same department or program.
Philosophical Inquiry: 8 quarter hours required.
Religious Dimensions: 8 quarter hours required. 4 quarter hours in patterns and problems, and 4 quarter hours in traditions in context.
Scientific Inquiry: not required.
Self, Society and the Modern World: 12 quarter hours required. At most 2 courses from the same department or program.
Understanding the Past: 8 quarter hours required; 4 quarter hours of history pre-1800 and 4 quarter hours of history primarily between 1800-1945. In addition, courses must be from two different categories: 1) Asia, 2) Latin America, 3) Africa, 4) North America or Europe and 5) intercontinental or comparative.

Although study in physics contributes to a student's liberal education, courses offered by the department of physics are not applied towards liberal studies requirements for the physics major. Exceptions to this rule are the junior experiential learning and the senior capstone requirements.

DEPARTMENTAL PROGRAM REQUIREMENTS

COMMON CORE
Physics: 170, 171, 172, 270.
Mathematics: 160,161, 162 or 170, 171, 172.

I. STANDARD CONCENTRATION
AFTER COMMON CORE:
Physics: 300 Methods of Computational and Theoretical Physics I; 301 Methods of Computational and Theoretical Physics II; 310 Mechanics I; 311 Mechanics II; 320 Electricity and Magnetism I; 321 Electricity and Magnetism II; 340 Thermal Physics; 350 Optics; 360 Modern Physics I; 361 Modern Physics II; 370 Electronics; 380 Experimental Physics I.

Mathematics: 260 Multivariable Calculus I; 261 Multivariable Calculus II.

II. APPLIED COMPUTATIONAL PHYSICS

AFTER COMMON CORE:

Physics: 300 Methods of Computational and Theoretical Physics I, 301 Methods of Computational and Theoretical Physics II, 310 Mechanics I, 320 Electricity and Magnetism I, 360 Modern Physics I, 342 Computational Physics, 390 Applied Computational Physics Laboratory.


Mathematics: 260 Multivariable Calculus I and 261 Multivariable Calculus II.

Computer Science: 215 Introduction to Structured Programming Using C++ or 225 C++ Language for Programmers.

Supporting Fields: Two from MAT 385, 386; CSC 310, 311, 325, 329; CHE 313.

III. ENGINEERING PHYSICS

DePaul University offers a joint program with the Illinois Institute of Technology (IIT) in physics and engineering. This programs allows students to enroll in courses at IIT while remaining full-time DePaul students. Students will receive a degree in Physics from DePaul University and a degree in Mechanical Engineering from IIT upon completion of the five-year program. Students can also choose a four-year joint program that leads to a degree only from DePaul or can choose to complete their engineering requirements at another university. Students interested in Engineering Physics or the joint program should promptly consult with a Physics Department advisor for information about scheduling, requirements, and admission to the joint program.

AFTER COMMON CORE:

Physics: 300 Methods of Computational and Theoretical Physics I, 301 Methods of Computational and Theoretical Physics II, 370 Electronics. Either 320 and 321 Electromagnetism or 360 and 361 Modern Physics. Two additional physics courses at the 300 or 400 level as approved by advisor.


Chemistry: 111 General and Analytical Chemistry I, 112 General and Analytical Chemistry I Laboratory, 113 General and Analytical Chemistry II, 114 General and Analytical Chemistry II Laboratory.

Supporting Fields: Twenty quarter hours at 300/400 level from an accredited Mechanical Engineering, Aerospace Engineering, or Aeronautical Engineering program.

IV. DESCRIPTIVE PHYSICS

AFTER COMMON CORE:

Physics: Six additional courses approved by a departmental advisor.

Supporting Fields: Seven courses which must include General Chemistry 111, 112, 113 and 114. Note: Physics 170, 171, and 172 may be replaced by Physics 150, 151, and 152. Mathematics 160, 161, and 162, may be replaced by Mathematics 150, 151, and 152.
V. TEACHER OF PHYSICS: SECONDARY LEVEL

The Department of Physics offers a concentration of study which combines the requirements for a major in Physics with certification for teaching physics at the junior high, middle, and senior high school levels. A student electing such a program should consult the School of Education counselor as well as the Physics counselor as soon as possible after entering DePaul.

AFTER COMMON CORE:

Standard program: 300 Methods of Computational and Theoretical Physics I, 301 Methods of Computational and Theoretical Physics II, 310 Mechanics I, and five additional Physics courses, chosen from Concentration I or III; Chemistry 111 General and Analytical Chemistry I, 112 General and Analytical Chemistry I Laboratory, 113 General and Analytical Chemistry II, 114 General and Analytical Chemistry II Laboratory, 115 General and Analytical Chemistry III and 116 General and Analytical Chemistry III Laboratory; Education 339 Teaching Science in the Secondary School; Mathematics 260 Multivariable Calculus I and 261 Multivariable Calculus II.

SEQUENCING

It is extremely important that students interested in majoring in Physics begin the Calculus sequence in the first year of study so that they can complete the degree requirements in four years. Two options are available. The student may place directly into the Calculus sequence (Mathematics 160, 161, 162), or the student may place into Mathematics 131 (Trigonometry and Precalculus). Those students that place into Mathematics 160 should enroll in that course in their first quarter at DePaul. Students that place into Mathematics 131 are strongly advised to take Mathematics 147, 148, 149 (Calculus with Integrated Precalculus I, II and III) during their first year at DePaul. Another option for these students would be to take Mathematics 131 and Mathematics 160 concurrently in the Autumn Quarter.

Students interested in Physics should also enroll in University Physics (Physics 170, 171, 172) during their first year. This sequence, along with the Calculus courses discussed above, are prerequisites to Physics 270, Physics 300, Physics 301, and Physics 370, which should be taken in the sophomore year along with Mathematics 260 and 261, Multivariable Calculus. All remaining courses are determined by the requirements of the concentration.

Students interested in Engineering Physics or Pre-engineering are urged to consult with a Physics Department advisor as soon as practicable.

The predominance of Physics, Mathematics, and Chemistry sequences in the freshman and sophomore years requires that the majority of Liberal Studies courses be postponed until the junior and senior years. Students should therefore take fewer Liberal Studies courses in the first two years, concentrating instead on major field requirements which are prerequisite to upper division courses.
SPECIAL PROGRAMS

PRE-ENGINEERING

The Pre-engineering Program is an important component of the Physics Department curriculum. It is an alternative to the Engineering Physics concentration and is designed to provide students that wish to attend DePaul University for one or two years with the scientific background necessary to complete a degree program in engineering at another institution. Under this program, DePaul University does not grant a degree but students benefit from the high faculty-to-student ratio in courses and the opportunity to work in faculty research labs.

MASTER OF SCIENCE DEGREE

Students intending to pursue a graduate Physics program should complete as many of the required courses as possible by the end of the junior year and should take additional graduate courses during their senior year. Following this plan, a student should be able to complete the B.S. and M.S. in five years. All departmental majors are encouraged to participate in research.

DOUBLE MAJOR

Students interested in a double major such as Mathematics and Physics, may elect a sufficient number of advanced mathematical science courses (generally six to eight) to satisfy the requirements of the concentration of their choice.

PHYSICS MINOR

A student majoring in another field of study may obtain a minor in Physics by taking six courses in Physics. For a standard Physics minor, three of these courses must be either 150, 151, 152 or 170, 171, 172. For a Microelectronics minor, three of these courses must be 110, 232 and 312 with three additional courses chosen from 150, 151, 152, 170, 171, 172, 206, 231, 331.

Note for Computer Science majors: A Microelectronics minor may be obtained by taking either the 150 or 170 course sequence and 110, 232 and 312. A computational physics minor may be obtained by taking the core curriculum and 300, 301.

Note for Recording Sound Technology majors in the School of Music: A Microelectronics minor may be obtained by taking one additional course.

RESEARCH AT ARGONNE NATIONAL LABORATORY

College juniors and seniors with a minimum GPA 3.0/4.0 who are U.S. citizens or permanent residents may apply for the Science and Engineering Research Semester (SERS) at Argonne. The SERS program pays a stipend, plus housing and travel. For more details write to: Science and Engineering Research Semester, Division of Educational Programs, Argonne National Laboratory, Argonne, IL 60439-4845 and contact the Physics Department chair.
PHYSICS
General
PHY 104 The Sun and Its Planets
PHY 114 Exploring Other Worlds
PHY 115 Exploring the Universe I
PHY 118 Exploring the Universe II
PHY 150 General Physics I
PHY 151 General Physics II
PHY 152 General Physics III
PHY 155 General Physics
PHY 156 General Physics II
PHY 200 Light and Atoms
PHY 201 The Atmosphere and the Oceans
PHY 204 Frontiers of the Universe
PHY 206 Sound and Acoustics
PHY 223 Light, Color, and Photography

Major Field Courses
PHY 170 University Physics I
PHY 171 University Physics II
PHY 172 University Physics III
PHY 270 University Physics IV
PHY 300 Methods of Computational and theoretical Physics I
PHY 301 Methods of Computational and theoretical Physics II
PHY 310 Mechanics I
PHY 311 Mechanics II
PHY 315 Chaos in Physical Systems
PHY 320 Electricity and Magnetism I
PHY 321 Electricity and Magnetism II
PHY 325 Laser Physics
PHY 330 Senior Capstone Physical Science
PHY 340 Thermal Physics
PHY 342 Computational Physics
PHY 350 Optics
PHY 356 Fiber Optics
PHY 360 Quantum Mechanics I
PHY 361 Quantum Mechanics II
PHY 366 Radiation Physics
PHY 370 Electronics
PHY 378 Topics in Applied Physics
PHY 380 Experimental Physics I
PHY 381 Experimental Physics II
PHY 384 Advanced Laboratory
PHY 390 Applied Computational Physics Laboratory
PHY 395 Methods of theoretical Physics
PHY 398 Reading and Research
PHY 399 Independent Study

Microelectronics Courses
PHY 110 Basic Electronics
PHY 231 Linear Electric Circuits
PHY 232 Introduction to Digital Electronics
PHY 312 Introduction to Computer interfacing

COURSES

Unless otherwise specified, all courses carry 4 quarter hours credit.

Courses 150 through 156 are offered primarily for students (such as those in programs in the biological and medical sciences) whose requirements call for a one-year course (with laboratory) in General Physics without calculus.

All lab courses require the payment of a lab fee of $30 per course.

PHY 104 THE SUN AND ITS PLANETS Focuses on the development of our knowledge about the Solar System with an emphasis on the origin, structure and motion of the planets and the Sun. Topics include both historical astronomy and our current understanding based on information from spacecraft sent to other planets. Cannot receive credit for both PHY 104 and PHY 114. (Lab fee)

PHY 110 BASIC ELECTRONICS Introduction to analog electronics that develops the basic principles needed to understand consumer electronics. Emphasis is given to audio applications, but the same basic principles are the foundation of modern computer technology. (Lab fee)

PHY 114 EXPLORING OTHER WORLDS Activity-based course that compares the local environment of Earth in the Solar System to worlds and environments elsewhere in the Universe. Cannot receive credit for both PHY 104 and PHY 114. (Lab fee)

PHY 115 EXPLORING THE UNIVERSE I (2 credit hours) Modern explorations of the earth, the sky and the solar system.

PHY 118 EXPLORING THE UNIVERSE II (2 credit hours) Modern explorations of the stars, the galaxies and the cosmos.

PHY 150 GENERAL PHYSICS I Mechanics, vibrations and fluids. (Lab fee) PREREQUISITE(S): MAT 131 or higher placement by the Mathematics Diagnostic Test.

PHY 151 GENERAL PHYSICS II Heat, thermodynamics, sound and light. (Lab Fee) PREREQUISITE(S): PHY 150.

PHY 152 GENERAL PHYSICS III Electricity, magnetism and modern physics. (Lab Fee) PREREQUISITE(S): PHY 151.

PHY 155 GENERAL PHYSICS (6 credit hours) Includes Physics 150 plus half of 151. Summer only (Lab Fee) PREREQUISITE(S): MAT 131 or higher placement by the Mathematics Diagnostic Test.

PHY 156 GENERAL PHYSICS (6 credit hours) Includes half of PHY 151 plus 152. Summer only. (Lab Fee) PREREQUISITE(S): PHY 155.

PHY 170 UNIVERSITY PHYSICS I Mechanics and fluids. (Lab Fee) (Autumn) COREQUISITE(S): MAT 160 or 170 or 147.

PHY 171 UNIVERSITY PHYSICS II Heat, sound and light. (Lab Fee) (Winter) PREREQUISITE(S): PHY 170. COREQUISITE(S): MAT 161 or 171 or 148.

PHY 172 UNIVERSITY PHYSICS III Electricity and magnetism. (Lab Fee) (Spring) PREREQUISITE(S): PHY 171. COREQUISITE(S): MAT 162 or 172 or 149.

PHY 200 LIGHT AND ATOMS A conceptual treatment of light and matter, which emphasizes the counter-intuitive behavior of atoms, electrons and photons. Topics covered include the electrical nature of matter, wave-particle duality, the uncertainty principle, and philosophical implications. Some applications to technology will also be discussed such as lasers, fiber optic communication, superconductivity, and magnetic storage of data. (Lab fee)
PHY 201 THE ATMOSPHERE AND THE OCEANS Develops the physical concepts needed to understand the atmosphere, the oceans, and their interactions with the aim of building a conceptual model of weather and climate. Long-term climate variability and climate related environmental issues are also discussed.

PHY 204 FRONTIERS OF THE UNIVERSE Focuses on the tremendous increase in our understanding of the universe beyond the Solar System that has occurred in recent years. Topics include stellar evolution, the properties of stars, supernova explosions, black holes, galaxies, and the origin of the universe.

PHY 206 SOUND AND ACOUSTICS Sound waves, their production, transmission and detection; applications to music, acoustics and noise pollution. (Lab fee)

PHY 223 LIGHT, COLOR, AND PHOTOGRAPHY Principles of image formation with lenses and mirrors. Discussion of color, interference, polarization, and diffraction. Introduction to cameras and film, lasers and holography. (Lab fee)

PHY 231 LINEAR ELECTRIC CIRCUITS Frequency response and feedback, operational amplifiers as linear amplifiers, active filters, oscillators, communication circuits and data conversion circuits. (Lab fee) PREREQUISITE(S): PHY 110.

PHY 232 INTRODUCTION TO DIGITAL ELECTRONICS Principles of combinational logic circuits. Boolean algebra and Boolean function simplification. State diagrams and sequential logic circuits, and MSI devices. Digital circuit prototyping using SSI components. (Lab fee)

PHY 270 UNIVERSITY PHYSICS IV 20th-century physics. (Lab Fee) (Autumn) PREREQUISITE(S): PHY 172.

PHY 300 METHODS OF COMPUTATIONAL AND THEORETICAL PHYSICS I Computational and theoretical methods in ordinary differential equations, complex numbers, systems of equations, phase plane analysis, bifurcation's. Applications to damped, driven oscillators, electronics. (Lab Fee) (Winter) COREQUISITE(S): MAT 261.

PHY 301 METHODS OF COMPUTATIONAL AND THEORETICAL PHYSICS II Fourier series, partial differential equations, Legendre polynomials, special functions. Applications to wave motion, electricity and magnetism, modern physics, optics. (Lab Fee) Spring. PREREQUISITE(S): PHY 300.

PHY 310 MECHANICS I One, two, and three-dimensional motion, conservative systems, Lagrangian and Hamiltonian mechanics, central-force problems. PREREQUISITE(S): PHY 300.

PHY 311 MECHANICS II Systems of particles, collisions and scattering, motion in rotating frames, rigid body motion. PREREQUISITE(S): PHY 310.

PHY 312 INTRODUCTION TO COMPUTER INTERFACING Microcomputer-based laboratory treats the design of simple interfacing circuits and programs suitable for experimental work. Intended for Computer Science, Psychology, Sound Recording Technology and experimental science majors. (Lab fee) PREREQUISITE(S): One microelectronics course or PHY 172.

PHY 315 CHAOS IN PHYSICAL SYSTEMS Motion in phase space, characteristics of chaotic systems, Lyapunov exponents, stability of equilibrium solutions, strange attractors, bifurcation's, discrete dynamics, and applications to lasers, fluids, and other physical systems. PREREQUISITE(S): PHY 300.
PHY 320 ELECTRICITY AND MAGNETISM I Electrostatics, magnetostatics, and boundary-value problems. PREREQUISITE(S): PHY 301.

PHY 321 ELECTRICITY AND MAGNETISM II Time varying fields, electromagnetic waves, and radiation. PREREQUISITE(S): PHY 320.

PHY 325 LASER PHYSICS Interaction of radiation and matter, pumping mechanisms for lasers, optical resonators, cw and transient laser behavior, laser types, current topics in optical physics. PREREQUISITE(S): PHY 300.

PHY 330 SENIOR CAPSTONE PHYSICAL SCIENCE Topics in the physical sciences and their social, political, environmental and economic impact. PREREQUISITE(S): Junior or senior standing.

PHY 340 THERMAL PHYSICS Statistical interpretation of the laws of thermodynamics and physical applications. PREREQUISITE(S): PHY 301.

PHY 342 COMPUTATIONAL PHYSICS Computational solution and simulation of physical systems; applications chosen from nonlinear dynamics, optics, central-force motion, fluids, condensed matter. PREREQUISITE(S): PHY 301.


PHY 356 FIBER OPTICS Solution of Maxwell’s equations for dielectric waveguides, optical communications, nonlinear effects in dielectric waveguides, and current research. PREREQUISITE(S): PHY 320.

PHY 360 QUANTUM MECHANICS I Introduction to quantum mechanics, including the solution of the Schrodinger equation in one and three dimensions for a variety of potentials. Applications to atomic systems and solids. PREREQUISITE(S): PHY 301.

PHY 361 QUANTUM MECHANICS II Applications of quantum mechanics, including time-independent and time-dependent perturbation theory, the variational principle, and an introduction to scattering theory. PREREQUISITE(S): PHY 360.

PHY 366 RADIATION PHYSICS (Cross-listed with PHY 466) Radioactive decay processes, interactions of radiation with matter, general properties of radiation detectors, and applications to basic nuclear spectroscopy, health physics and medical physics. PREREQUISITE(S): PHY 270.

PHY 370 ELECTRONICS A laboratory course covering analysis and construction of analog and digital circuits used in experimental research. (Lab fee) PREREQUISITE(S): PHY 172.

PHY 378 TOPICS IN APPLIED PHYSICS Current topics in applied physics, as determined by the interests of the instructor and students. PREREQUISITE(S): PHY 301.

PHY 380 EXPERIMENTAL PHYSICS I Experimental techniques in optics, atomic and nuclear physics. Approved for Experiential Learning. Laboratory. Credit. PREREQUISITE(S): PHY 270.

PHY 381 EXPERIMENTAL PHYSICS II Experimental techniques in solid-state and high-vacuum physics. PREREQUISITE(S): PHY 380. Laboratory.

PHY 382 EXPERIMENTAL PHYSICS III Laboratory. PREREQUISITE(S): PHY 381

PHY 384 ADVANCED LABORATORY Variable credit. Laboratory experience in techniques selected in consultation with instructor. (Lab fee) PREREQUISITE(S): Consent.
PHY 390 APPLIED COMPUTATIONAL PHYSICS LABORATORY Project-based computational laboratory of problems in modern applied physics. Numerical modeling of experiments, computer interfacing of experiments, computational techniques in data analysis. PREREQUISITE(S): PHY 301.

PHY 395 METHODS OF THEORETICAL PHYSICS Special functions, complex integration, calculus of variations, coordinate transformations. PREREQUISITE(S): PHY 301.

PHY 398 READING AND RESEARCH Undergraduate research participation. Variable credit. PREREQUISITE(S): Consent.

PHY 399 INDEPENDENT STUDY Variable credit. PREREQUISITE(S): Consent.