PROGRAM IN PHYSICS
Ian Bentley, Program Director
B07 Science Hall
574-284-4662

FACULTY
M. Becker, I. Bentley, J. Mason

PROGRAM DESCRIPTION
The program in physics allows students to investigate the microscopic and the macroscopic through courses covering topics such as astronomy, nuclear physics, classical mechanics, modern physics, and quantum mechanics.

The B.S. in Physics is a curriculum designed to prepare students for graduate school in physics. The B.S. in Physics also provides adequate preparation for traditional physics professions in the private sector, the military, academia and national laboratories. Physicists work in industries including construction, education, energy, defense, finance, law, medical, music, space, sports, television, transportation, and even video game development.

The B.A. in Physics is highly flexible, making it possible to combine studies in physics with other programs, thereby supporting careers in biophysics, computational modeling, economic modeling, history of science, medicine, philosophy of science, physical chemistry and teaching high school science.

For those interested in a career in aerospace, structural civil, electrical, or mechanical engineering, the degrees offered in Physics, both B.A. and B.S., nicely complement the Five-Year Dual Degree Program in Engineering with the University of Notre Dame.

PROGRAM LEARNING OUTCOMES
Upon graduation, students will be able to:

• create a conceptual framework for modeling a system using laws of nature, physical principles, and other practical constraints.

• produce concise solutions to physical problems.

• apply knowledge of physics and mathematics to real world situations.

• demonstrate essential research skills including: practicing laboratory safety and performing error analysis.

• critically evaluate scientific literature.

• effectively communicate scientific results.

SENIOR COMPREHENSIVE
The Senior Comprehensive requirement in Physics is fulfilled by successfully completing two presentations, one in a poster format and one 15 minute oral presentation. Both are given in the second semester of the senior year and include a question and answer period with faculty. The topic of the presentation may be based on experimental laboratory research performed at Saint Mary’s or at another institution, or literature research on an approved topic. Emphasis is placed on explaining the physics of the research. An abstract of the topic is also required prior to the oral presentation.

ADVANCED WRITING PROFICIENCY
Each student writes a formal paper consisting of a technical discussion of the relevant physical principles, mathematics and methods related to her oral comprehensive presentation. These are normally submitted during the first semester of the senior year.

PROGRAM IN PHYSICS
Bachelor of Science, Major in Physics—PHYS (60 hours)
All of the following:

PHYS 121 General Physics I lab 4 hours
PHYS 122 General Physics II lab 4 hours
PHYS 253 General Physics III 3 hours
PHYS 323 Classical Mechanics 3 hours
PHYS 343 Thermodynamics 3 hours
PHYS 424 Quantum Mechanics 3 hours
PHYS 444 Electricity and Magnetism 3 hours

Two of the following:

PHYS 272L Computational Physics Laboratory lab 1 hour
PHYS 282L Modern Experimental Laboratory lab 1 hour
PHYS 292L Wave Mechanics Laboratory lab 1 hour

Required Supporting Courses:

CHEM 121 Principles of Chemistry I lab 4 hours
CHEM 122 Principles of Chemistry II lab 4 hours
CPSC 207 Computer Programming 3 hours
MATH 131-132 Calculus I, II 8 hours
or MATH 133 Theory and Application of Calculus 4 hours
MATH 231 Calculus III 4 hours
MATH 326 Linear Algebra and Differential Equations 4 hours

Two of the following:

CHEM 221 Organic Chemistry I 3 hours
CHEM 222 Organic Chemistry II 3 hours
CPSC 315 Simulation: Theory and Application 3 hours
CPSC 328 Data Structures 3 hours
MATH 335 Differential Equations II 3 hours
MATH 336 Numerical Analysis 3 hours
MATH 345 Probability 3 hours
MATH 346 Statistics 3 hours
PHYS 215 Materials Science 3 hours
PHYS 232 Astrophysics 3 hours
PHYS 235 Nuclear Physics 3 hours

Additional technical electives in science, computer science, mathematics, or engineering to total 60 credit hours.

Bachelor of Arts, Major in Physics—PHYS (37–41 hours)
All of the following:

PHYS 121 General Physics I lab 4 hours
PHYS 122 General Physics II lab 4 hours
PHYS 253 General Physics III 3 hours

Two of the following:

PHYS 272L Computational Physics Laboratory lab 1 hour
PHYS 282L Modern Experimental Laboratory lab 1 hour
PHYS 292L Wave Mechanics Laboratory lab 1 hour
Three of the following:

- PHYS 323 Classical Mechanics 3 hours
- PHYS 343 Thermodynamics 3 hours
- PHYS 424 Quantum Mechanics 3 hours
- PHYS 444 Electricity and Magnetism 3 hours

One additional 200+ level PHYS course.

Required Supporting Courses:

- MATH 131-132 Calculus I, II 8 hours
- or MATH 133 Theory and Application of Calculus 4 hours
- MATH 231 Calculus III 4 hours
- MATH 326 Linear Algebra and Differential Equations 4 hours

Minor in Physics—PHYS (17 hours)

All of the following:

- PHYS 121 General Physics I lab 4 hours
- or PHYS 111 College Physics I lab 4 hours
- PHYS 122 General Physics II lab 4 hours
- or PHYS 112 College Physics II lab 4 hours

Three of the following:

- PHYS 215 Materials Science 3 hours
- PHYS 232 Astrophysics 3 hours
- PHYS 235 Nuclear Science 3 hours
- PHYS 253 Modern Physics 3 hours
- PHYS 323 Classical Mechanics 3 hours
- PHYS 343 Thermodynamics 3 hours
- PHYS 424 Quantum Mechanics 3 hours
- PHYS 444 Electricity and Magnetism 3 hours

PHYSICS COURSES (PHYS)

101 Introductory Topics in Physics: Motion (4)
An introduction to concepts, applications, and history of physics via exploration of everyday motion. The primary goal of this conceptually-based course is to convey an understanding of science as a way of viewing the natural world. The laboratory introduces fundamental principles of scientific investigation via experimental exploration. This course is intended for students not majoring in science. (Three hours lecture and a two-hour laboratory). Prerequisite: None.

102 Introductory Topics in Physics: Energy (4)
An introduction to concepts, and applications of physics through the lens of energy. This course deals with the science of national and global energy concerns. The laboratory introduces fundamental principles of scientific investigation via experimental exploration. This course is intended for students not majoring in science. (Three hours lecture and a two-hour laboratory). Prerequisite: None.

104 Introductory Physics (3)
An introduction to concepts and applications of physics via an overview of topics in physics chosen from motion, energy, wave phenomena, optics, or other basic physics themes. The primary goal of this course is to convey an understanding of science as a way of viewing the natural world. The course will require some basic algebra. (Three hours lecture). Prerequisite: None.

105 Astronomy (3)
A study of stars and galaxies within the Universe from our Earth based perspective. Scientific techniques and the history of scientific observation are included in addition to the properties of light and gravity. This course is intended for students not majoring in science or mathematics. (Three hours lecture). Prerequisite: None.

111 College Physics I: Mechanics and Waves (4)
An introduction to mechanics, and waves. This is the first semester of a two-part algebra-based physics sequence designed primarily for students in life-sciences (biology, and neuroscience), communications sciences and disorders, and environmental studies. (Three hours of lecture and two hours laboratory). Prerequisite: MATH 103.
321 Lagrangian Mechanics (1)
This course will cover topics in classical mechanics including wave motion. The primary focus is the Lagrange formalism which is used to setup simple differential equations and solve for equations of motion. This course covers the same material as PHYS 323 but only lasts for the first third of the semester. This course is intended for students who are also required to take additional courses in mechanics. Typically offered fall of even-numbered years. (Three hours lecture). Prerequisite: PHYS 253.

323 Classical Mechanics (3)
A detailed study of classical mechanics including Newton's laws, and conservation laws. Equations of motion are derived based on the Lagrange and Hamiltonian formalisms. Typically offered fall of even-numbered years. (Three hours lecture). Prerequisite: PHYS 253.

341 Statistical Mechanics (1)
This course will cover topics in thermodynamics from a statistical mechanics viewpoint. Systems containing large numbers of particles will be analyzed using Boltzmann statistics. This course covers the same material as PHYS 343 but only lasts for the first third of the semester. This course is intended for students who are also required to take additional courses in Thermodynamics. Typically offered fall of odd-numbered years. (Three hours lecture). Prerequisite: PHYS 253.

343 Thermodynamics (3)
A detailed study of statistical mechanics and thermodynamics. Systems containing large numbers of particles will be analyzed using Boltzmann statistics. The laws of thermodynamics will be introduced. Cyclic processes and other thermodynamic concepts will be developed. Typically offered fall of even-numbered years. (Three hours lecture). Prerequisite: PHYS 253.

424 Quantum Mechanics (3)
A detailed physical and mathematical study of quantum mechanics including wave mechanics. Physical applications of quantum mechanics are also discussed. Typically offered fall of even-numbered years. (Three hours lecture). Prerequisites: PHYS 253 and MATH 326.

444 Electricity and Magnetism (3)
A detailed physical and mathematical study of electricity and magnetism focusing on applications from vector calculus. Interactions between electric and magnetic fields are explored including the use of Maxwell's equations. Typically offered fall of odd-numbered years. (Three hours lecture). Prerequisites: PHYS 253 and MATH 326.

460 Mathematical Methods (3)
An introduction of mathematical topics including vector calculus, differential equations, probability and statistics. These topics are often of interest to scientist and engineers. Offered based on student demand. (Three hours lecture). Prerequisites: PHYS 253 and MATH 326.

PROGRAM IN COMMUNICATION STUDIES

FACULTY
S. Baxter, C. Fitzpatrick, H. Ho, M. Kramer, T. Russ

PROGRAM DESCRIPTION
The Department of Communication Studies, Dance & Theatre offers a Bachelor of Arts major in Communication Studies. The department also offers a minor in Public Relations and Advertising.

PROGRAM LEARNING OUTCOMES
• Students will be able to identify and explain various communication theories and apply them to understand texts, events, relationships, messages, or settings.
• Students will be able to explain how communication and media institutions shape selected dimensions of social life (politics, law, ethics, gender, or culture).
• Students will be able to communicate clearly and ethically in a variety of contexts and formats (written, visual, oral, and mediated).

ADVANCED WRITING PROFICIENCY
Students complete this requirement by submitting a portfolio of writing samples from three categories that correspond to the curriculum requirement. The portfolio consists of papers prepared for courses in the major in Communication Studies. The portfolio is submitted for review in the spring of the senior year.

SENIOR COMPREHENSIVE
Students may complete the Senior Comprehensive in one of two sequences of courses reflecting the main intellectual traditions of the communication discipline: 1) research methods (COMM 385, 496), which explores social-scientific and qualitative methods of inquiry, or 2) rhetorical criticism (COMM 302,495), focusing on the critical analysis of all types of public communication. The first course in either sequence must be taken in the spring of the Junior year, the second in the fall of the Senior year.