Department of Physics
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Web: www.gvsu.edu

Physics (PHY)

Physicists are explorers of the physical universe. They seek to know and understand the fundamental behavior of nature, from elementary particles to the galaxies. Physicists must develop both experimental and analytical skills to carry out their search for a detailed description of the behavior of matter and energy.

Career Opportunities

Problem-solving skills mastered by the physics major make physics an excellent background for many professions. Employment opportunities exist in education, industry, and research. In particular, there is an enormous need for properly prepared secondary school physics teachers.

Physicists are commonly employed in industry, private institutions, and government, normally working as part of a team of scientists and engineers. With an advanced degree, more responsible positions in research are available, as are teaching opportunities in colleges and universities.

A physics degree is also an excellent background for positions or further education in engineering and other professional fields. Medical and law schools are enthusiastic about well-prepared applicants who hold physics degrees. Physics graduates are also especially well-qualified to pursue advanced degrees in patent law or medical physics, both of which offer excellent employment opportunities.

Programs Offered in Physics

The Physics Department offers a bachelor's degree with a major in physics. This is a well-defined program of observation, experimentation, and theoretical study of the various phenomena of nature. The department also offers a minor in physics and the option for secondary teacher certification with the major or minor. In addition, the College of Education in cooperation with the department of physics offers the M.Ed. degree with an emphasis in physics.

The undergraduate physics curriculum requires careful planning because most courses in chemistry, mathematics, and physics can be taken only in sequence. Students who expect to major or minor in physics should consult a faculty member of the Physics Department to plan their programs at the earliest opportunity, preferably before registration for their first term. It is especially important that transfer students meet with a department faculty advisor to evaluate previous work and plan an appropriate program of study.

Major Requirements — B.S. in Physics

Students who expect to complete the program in four years should have had four years of high school mathematics, including geometry, trigonometry, and two years of algebra; three years of laboratory science, including a year each of physics and chemistry; and four years of English. Students who do not have these courses should plan to take appropriate courses during their freshman year.

Physics majors must meet the university's general degree requirements and complete 39 semester credit hours of core physics courses and 36 credit hours of cognate courses with a minimum grade of C (2.0) in each course. Transfer students must complete at least 11 credit hours in physics courses at Grand Valley at the 300 level or above.

Minor Requirements — Physics

The physics minor requires a minimum of 24 credit hours in physics with a grade point average of 2.0. Three courses are required for the minor: PHY 230, 231, and 302. The remaining 10 hours in physics must be selected from the following: PHY 309, 311, 320, 330, 340, 350, 360, and 370.

Certification for Secondary Teaching

All students seeking certification to teach physics at the secondary level must complete either a major or minor in physics with a minimum cumulative GPA of 2.8. Students must also complete the following 39-credit certification program in the College of Education: ED 200, ED 205, ED 225, PSY 301, PSY 325, ED 310, ED 321, ED 331, and ED 431. The first five courses in the list may be taken before admission to the Undergraduate Teacher Education program. The last four courses, which include secondary teacher assisting (ED 321) and student teaching (ED 431), usually require a full fifth year to complete.

In addition, all students (whether majors or minors) are required to assist for at least 30 clock hours in the

department's tutoring program and for at least 30 clock hours as a laboratory assistant setting up equipment and helping students in a laboratory setting. Required reading and training in laboratory safety will be part of this experience.

Finally, students pursuing the physics major (not the minor) with secondary certification must take the following additional courses: HSC 201 or 202, PHY 105, BIO 336 (or another science ethics course), and BIO 120.

Sample Curriculum — B.S. in Physics

The following example course sequence assumes a good mathematics background.

First Year
CHM 115 Principles of Chemistry I
CHM 116 Principles of Chemistry II
MTH 201 Calculus I
MTH 202 Calculus II
PHY 230 Principles of Physics I
WRT 150 Strategies in Writing
General education course

Second Year
CS 261 Structured Programming in C
MTH 203 Calculus III
MTH 227 Linear Algebra I
MTH 304 Analysis of Differential Equations
(MTH 302 can replace MTH 227 & 304)
PHY 231 Principles of Physics II
PHY 302 Introduction to Modern Physics
Two general education courses

Third Year
MTH 300 Applied Analysis I
PHY 309 Advanced Laboratory I
PHY 311 Advanced Laboratory II
PHY 330 Intermediate Mechanics
PHY 340 Intermediate Electricity and Magnetism
Four general education courses (begin theme)
Electives

Fourth Year
PHY 350 Quantum Mechanics
PHY 360 Thermodynamics
PHY 485 Senior Project I
PHY 486 Senior Project II
Two general education courses (finish theme)
Electives

Students intending to pursue subsequent graduate study in physics should take as many upper level physics electives as possible. In particular, it is important to take the optional second semesters of classical mechanics (430), electrodynamics (440), and quantum mechanics (450). A sample curriculum for that option appears on the Physics Department website: www.gvsu.edu/physics.

Master of Education (M.Ed.) Degree

The M.Ed. degree with a concentration in physics, offered by the College of Education in cooperation with the Department of Physics, provides high school and middle school teachers the opportunity to expand their knowledge of physics pedagogy and to deepen their understanding of physics.

Curriculum Overview

The program requires completion of 33 graduate credits: 18 credits in education and 15 in physics. At least 12

physics credits must be taken at the 600-level, which are courses specially designed for teachers. Specific degree requirements can be found in the graduate program section of the College of Education description in the Grand Valley State University Undergraduate and Graduate Catalog.

Upon admission to the program, each student will meet with an advisor from the Physics Department to evaluate previous physics coursework and devise a curricular plan reflecting the student's needs, interests, and goals.

Admission

Admission to the M.Ed. Program requires teaching certification with either a major or a minor in physics, or a major in chemistry, mathematics, or integrated science. A demonstrated proficiency in physics at the one-year introductory level (PHY 220/221 or PHY 230/231 or equivalent) is required. Students must submit three letters of recommendation, transcripts, and copies of teaching certificates. Students must have at least a 3.0 cumulative GPA. For additional details, see the College of Education section of the GVSU Undergraduate and Graduate Catalog.

Courses of Instruction

PHY 105 Descriptive Astronomy
PHY 106 Science, Technology, and Society
PHY 108 Science and Science Fiction
PHY 180 Selected Topics in Physics
PHY 200 Physics for the Life Sciences
PHY 201 Inquiry: The Mechanical and Thermal World
PHY 204 Inquiry: Electricity, Magnetism, and Optics
PHY 205 Astronomy for K-8 Pre-Service Teachers
PHY 210 Math Topics in Physics
PHY 211 Math Topics in Physics II
PHY 220 General Physics I
PHY 221 General Physics II
PHY 226 Digital Electronics
PHY 230 Principles of Physics I
PHY 231 Principles of Physics II
PHY 234 Engineering Physics
PHY 280 Selected Topics in Physics
PHY 302 Introduction to Modern Physics
PHY 303 World after Einstein
PHY 306 Physics of Sports
PHY 307 Light and Sound
PHY 309 Advanced Laboratory I
PHY 311 Advanced Laboratory II
PHY 320 Optics
PHY 330 Intermediate Mechanics
PHY 340 Electromagnetic Fields
PHY 350 Quantum Mechanics
PHY 360 Statistical Thermodynamics
PHY 370 Solid State Physics
PHY 380 Special Topics in Physics
PHY 399 Readings in Physics
PHY 430 Advanced Mechanics
PHY 440 Advanced Electricity and Magnetism
PHY 450 Advanced Quantum Mechanics
PHY 480 Selected Topics in Physics
PHY 485 Senior Physics Project (capstone)
PHY 486 Senior Physics Project (capstone)
PHY 499 Research in Physics
PHY 555 Physics Content Enhancement
PHY 601 Physics by Inquiry I
PHY 605 General Astronomy
PHY 610 Measurement and Instrumentation in the Physics Lab

PHY 620 Methods and Materials for Physics Demonstrations
PHY 630 Teaching Conceptual Physics
PHY 650 Software and Interactive Physics
PHY 660 Readings in Physics Education Research
PHY 670 Modern Physics with Computer Visualization
PHY 680 Selected Topics in Physics

Faculty Members

Bradley S. Ambrose, Associate Professor; Ph.D., University of Washington; Physics Education Research.

Natalie Beyer, Laboratory Coordinator; B.S., GVSU.

Javier Estrada, Professor; Ph.D., University of South Carolina; Superconductors.

Douglas Furton, Associate Professor and Chair; Ph.D., University of Toledo; Laboratory Astrophysics.

Karen Gipson, Associate Professor; Ph.D., Washington State University; Acoustics.

Geoffrey Lenters, Assistant Professor; Ph.D., University of Alabama in Huntsville; X-Ray Astrophysics.

Maja Krcmar, Assistant Professor; Ph.D., Texas A & M University; Computational Physics.

Kingshuk Majumdar, Assistant Professor; Ph.D., University of Florida, Gainesville; Condensed Matter Physics.

Keith Oliver, Assistant Professor; Ph.D., Ohio State University; Physics Education Research.

Milun Rakovic, Assistant Professor; Ph.D., University of Belgrade; Theoretical Physics.

Ross Reynolds, Professor; Ph.D., University of Oregon; X-ray crystallography.

Harold Schnyders, Assistant Professor; Ph.D., Michigan State University; Solid-state Physics.

Refer to www.gvsu.edu/catalog for the most current catalog information.

For More Information

For more information about physics at Grand Valley, contact:

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