PHYSICS

Department of Earth, Environment and Physics

Worcester State University offers a wide variety of introductory courses in physics and astronomy suitable for students fulfilling requirements as part of the Liberal Arts and Sciences Curriculum. These courses also are components of many STEM majors. Upper level courses are offered across physics and astronomy on a rotating basis. The Department of Earth, Environment, and Physics houses minors in both Physics and Astronomy.

Astronomy Minor

Physics Minor

Faculty

William Hansen, Professor (2005), B.A., State University of New York Albany; M.A., Hunter College; Ph.D., City University of New York Graduate Center

Maxim Lavrentovich, Assistant Professor (2023), B.A., Kenyon College; Ph.D., Harvard University

Nabin K. Malakar, Associate Professor (2017), M.S., Ph.D., University at Albany, State University of New York (SUNY)

Michael Ogunbunmi, Assistant Professor (2023), B.S., Ahmadu Bello University; M.S., African University of Science and Technology; Ph.D., University of Johannesburg

Ian W. Stephens, Assistant Professor (2020), B.S., Georgia Institute of Technology; Ph.D., University of Illinois at Urbana - Champaign

Courses

PY-101 Introduction to Astronomy
LASC Categories: NSP
Tools of the astronomer. The nature of stars, their location and cosmology. Planets and the solar system.
Fall and Spring and every year. 3 Credits

PY-105 How Stuff Works (concepts in Physics)
LASC Categories: NSP, LAB
Prerequisites: Math placement exam score of 3 or above or successful completion of college-level math class
Physics is all around you. It is in the sights you see, the sounds you hear, the things you feel, and even in your sense of taste. Stressing conceptual understanding and critical reasoning over quantitative analysis, this course aims to give students the background and habits of mind that will help them understand how the world works. Topics will include: Newton's Laws, energy, momentum, rotation, fluids, heat, and waves. The class is two hours lecture and one two-hour laboratory. Credit will not be awarded for more than one of PY 105, PY 221, and PY 241.
Spring only and every year. 3 Credits

PY-110 Astrophotography
LASC Categories: CA, NSP
The course aims to introduce the fundamental principles of astrophotography or imaging astronomical objects. We will be using optical telescopes to observe the night sky as well as the sun to understand astrophotography as a scientific tool to understand our universe.
Fall only and every 2-3 years. 3 Credits

PY-114 Physics of Waves
LASC Categories: NSP, QAC
Prerequisites: Math placement exam score of 3 or above or successful completion of a college-level math class.
Wave phenomena, including water waves, sound, acoustics, musical instruments, optics and quantum mechanics. Analysis of propagation, power, scattering and interference.
Spring only and every year. 3 Credits

PY-193 First Year Seminar
LASC Categories: FYS
Introductory level course covering topics of special interest to first-year students. Offered only as a First-Year Seminar.
Fall only and every 2-3 years. 3 Credits

PY-217 General Astronomy
LASC Categories: NSP
Prerequisites: MA-190 or an advanced calculus course (except MA 202). PY-101 suggested, but not required.
Algebra-based Astronomy course covering a breadth of topics, primarily focusing outside of the solar system. Topics include: nature and evolution of stars; supernova; white dwarfs, neutron stars, and black holes; galaxies, quasars, and dark matter; large scale structure of the universe; the Big Bang; and dark energy. Emphasis will be on the physical principles underlying the astronomical phenomena.
Spring only and every 2-3 years. 3 Credits

PY-220 Energy and the Environment
LASC Categories: NSP
Prerequisites: A college level math course or a math placement code 3.
Explore the important questions surrounding energy, environment, and climate.
Fall only and every 2-3 years. 3 Credits

PY-221 General Physics I
LASC Categories: LAB, NSP, QAC, QR
Prerequisites: MA-190 (or higher), or a math placement code of 7.
Physics with algebra and trigonometry, including kinematics, dynamics, energy, momentum, gravity, oscillators, waves, and heat. Three hours lecture and two hours lab. Credit will not be awarded for more than one of PY 105, PY 221, and PY 241.
Fall and Spring and every year. 4 Credits

PY-222 General Physics II
LASC Categories: LAB, NSP
Prerequisites: PY-221 or PY-241.
Physics with algebra and trigonometry including electric and magnetic fields, resistance, capacitance, inductance, reflection, refraction, interference, relativity, and quantum physics. Three hours lecture and two hours laboratory. Credit will not be awarded for more than one of PY 106, PY 222, and PY 242.
Fall and Spring and every year. 4 Credits

PY-241 Physics I (Mechanics)
LASC Categories: LAB, NSP, QAC
Prerequisites or Corequisite: one semester of calculus either previous or concurrent to PY 241.
Physics with calculus, including kinematics, dynamics, energy, momentum, gravity, oscillators, waves and heat. Three hours lecture and two hours lab. Credit will not be awarded for more than one of PY 105, PY 221, and PY 241.
Fall only and every year. 4 Credits

PY-242 Physics II (Electricity, Magnetism and Optics)
LASC Categories: LAB, NSP
Prerequisites: PY-241 and one semester of calculus.
Physics with calculus including electric and magnetic fields, resistance, capacitance, inductance, reflection, refraction, interference, relativity and quantum physics. Three hours lecture and two hours lab. Credit will not be awarded for more than one of PY 106, PY 222, and PY 242.
Spring only and every year. 4 Credits

PY-250 Observational Astronomy
LASC Categories: LAB, QAC, NSP
Prerequisites: MA-190
Orientation in the night sky. Use of telescopes and cameras. Conduct astronomical observations. Analysis and interpretation of astronomical data.
Spring only and every 2-3 years. 3 Credits

PY-297 Selected Topics in Physics
Lecture or laboratory course in a selected area in physics. Topics announced in advance. Prerequisite: Consent of Instructor.
1-6 Credits

PY-310 Modern Physics
Prerequisites: MA-200 and either PY-222 or PY-242
Special relativity. The wave nature of matter, introductory quantum mechanics, and atomic physics. Condensed matter. Radioactivity. Nuclear and particle physics.
Fall only and every 2-3 years. 3 Credits

PY-360 Introduction to Materials Science
Prerequisites: CH-120, CH-121, and either PY-221 and PY-222, or PY-241 and PY-242
Physical structures of solids. Electrical, magnetic, thermal and optical properties of solids, liquids and soft matter. Structure-property relationships in materials. Cross-listed with CH-360.
3 Credits

PY-370 Introduction to Nuclear Science
Prerequisites: CH-120, CH-121, MA-200, and either PY-221 and PY-222 or PY-241 and PY-242
Fundamentals of nuclear science. Topics include nuclear structure and forces, radioactive decays, nuclear reactions, and modern applications. Cross- listed with CH-370.
3 Credits

PY-408 Directed Study: Physics
Directed study offers students, who because of unusual circumstances may be unable to register for a course when offered, the opportunity to complete an existing course with an established syllabus under the direction and with agreement from a physics faculty member.
3-4 Credits

PY-410 Independent Study: Physics
Opportunity for advanced students to pursue a topic of special interest involving extensive reading, experimentation, and research. Prerequisite: Consent of Instructor.
1-6 Credits

PY-415 Advanced Physics-Astronomy Research and Fieldwork
Students develop and execute a research project in physics or astronomy under the supervision of a physics faculty member. May include the development of a formal proposal, background literature search, data collection either in the field or in a laboratory, analysis and interpretation of data, and production of a research paper summarizing the findings.
Other or on demand and other or on demand. 1-6 Credits

PY-460 Physics Internship
Advanced students assigned to external public or private agency, working under agency and physics faculty supervision. Prerequisite: Consent of physics faculty.
1-4 Credits