DEPARTMENT OF PHYSICS

125 Smith Hall
(585) 395-2182

Professor and Chair: Stanley F. Radford; Associate Professor: Mohammed Z. Tahar; Assistant Professors: H. Trevor Johnson-Steigelman, Eric M. Monier.

Physics is the study of the physical properties of the universe and of the fundamental properties and interactions of matter and energy. Physics has applications in every field of pure and applied science, such as engineering, optics, materials science, space science, and medicine. A degree in Physics is excellent preparation for:

• Graduate study in Physics, Astronomy, Mathematics, or Engineering; leading to a career in university and college teaching and research, or a leadership position in industrial or government research projects;

• Teaching at the middle and high school levels;

• Employment as an engineer or technician in an industry, government, or university laboratory;

• Professional school in law, medicine, or business.

Physics Major

Students majoring in Physics must take the Physics courses listed below and supporting courses in mathematics, chemistry and computational science. These courses will prepare students to attend graduate school in Physics or a related field; to teach Physics at the middle and high school levels; or to work as technicians or engineers in academia, industry, or government.

In addition to the physics major, the department also offers a **Minor** in physics.

Certification for Secondary Teaching in Physics

The Department of Physics, in conjunction with the Department of Education and Human Development, offers a program that leads Initial Teacher Certification in Adolescent Inclusive Education with Middle Childhood Extension (Grades 5-12). Students pursuing certification must satisfy course work outside the department in addition to satisfy the requirements for the Physics major. For a complete listing of the requirements for Teacher Certification, consult the Department of Education and Human Development section of this catalog.

Mathematical Preparation

Students planning to major in Physics should have completed algebra, geometry, trigonometry and pre-calculus in high school. Calculus is good preparation, but can be taken in the Freshman year at Brockport. Students who are unable to take Calculus I (MTH 201) in their first semester will be unable to complete a degree in Physics in four years without summer study.

While at The College at Brockport, SUNY, students majoring in Physics must complete courses in calculus and differential equations. Students who plan to go on to graduate study in physics or engineering should take additional mathematics courses with guidance from their advisors.

Requirements for a Major in Physics

Physics Courses:		**Credits**
Year 1		
PHS 235	Physics I	4
PHS 240	Physics II	4
Year 2		
PHS 307	Physics III	3
PHS 325	Intermediate Physics Laboratory	2
PHS 328	Modern Physics	3
PHS 332	Mathematical Methods of Physics	3
Year 3		
PHS 345	Advanced Physics Laboratory I	1
PHS 350	Advanced Physics Laboratory II	1
PHS 353	Classical Mechanics	3
PHS 361	Special Topics in Physics	3
PHS 368	Electricity and Magnetism	3
Year 4		
PHS 403	Physics Project Seminar I	1
PHS 404	Physics Project Seminar II	1
PHS 411	Quantum Mechanics	3
PHS 426	Advanced Theoretical Physics	3
	Total Physics courses:	38
Supporting Courses:		
MTH 201-202-203	Calculus I-II-III	12
MTH 255	Ordinary Differential Equations	3
CHM 205-206	College Chemistry I-II	8
CPS 201	Computational Tools I	3
CPS 202	Computational Tools II **OR**	3 **or**
CSC 203	Fundamentals of Computer Science I	4

Total Supporting courses:	**29 / 30**
Total credit hours for the physics major	**67 / 69**

Students planning to attend graduate school should take MTH 324 Linear Algebra and MTH 456 Advanced Differential Equations.

Requirements for a Minor in Physics

Year 1		
PHS 235	Physics I	4
PHS 240	Physics II	4
Year 2		
PHS 307	Physics III	3
PHS 325	Intermediate Physics Laboratory	2
PHS 328	Modern Physics	3
PHS 332	Mathematical Methods of Physics	3
	Total:	18

The Physics Major can be completed in four years. To make normal progress toward this goal, students should have completed the following courses by the end of the sophomore year: Years 1 and 2 of the Physics major courses, MTH 201, 202, 203, 255 and CHM 205 and 206.

Transfer students with a two-year degree from a community college wishing to major in Physics will most likely have to take PHS 307, 325 and 332, since these courses are usually not offered at community colleges. In addition, it would be beneficial for transfer students to have had a course in differential equations. The Physics major can still be completed in two years. It is important that transfer students meet with a Physics advisor before they register for their first semester courses. At this meeting their two-year schedule of courses can be established.

Teacher Certification can be completed in five years. Students wishing to pursue this option should have completed Years 1 and 2 of the Physics major courses by the end of the sophomore year. Students should meet with an advisor in the first semester to plan courses for the five years, including one semester entirely devoted to student teacher practicum. In addition to the requirements for the Physics major, students must also meet the requirements of the Department of Education and Human Development.

Transfer students pursuing Teacher Certification can expect to spend at least three years at The College at Brockport, SUNY. Students in this category should have completed the same courses as those listed above. Transfer students interested in Teacher Certification should seek advisement prior to registering for their first semester of Brockport courses.

Physics Courses

Physics

PHS 101 The Physics in Toys (A,N). Explores the theoretical bases and general principles of classical physics (mechanics, electricity, magnetism, and optics) at an introductory college level. Presents important physical principles in these areas. Employs extensive demonstrations using a large collection of machines and toys. Three hours of lecture/demonstration per week. *3Cr. Every semester.*

PHS 205 Introduction to Physics I (A,L). *Prerequisite: MTH 122*. Algebra-based introductory physics. Covers the fundamental principles of mechanics. Covers linear, rotational, and oscillatory motion including kinematics, Newton's laws, and energy and momentum and their conservation laws. Experiments explore the topics covered in the lectures. Closed to anyone who has successfully completed PHS 235. Three hours of lecture and three hours of lab per week. May not be applied to Major or Minor programs in Physics. *4 Cr. Fall.*

PHS 210 Introduction to Physics II (A,L). *Prerequisite: PHS 205 or 235.* Algebra-based introductory physics. Covers sound, thermodynamics, electricity and magnetism, light, and modern physics. Experiments explore the topics covered in the lectures. Closed to anyone who has successfully completed PHS 240. Three hours of lecture and three hours of lab per week. May not be applied to Major or Minor programs in Physics. *4 Cr. Spring.*

PHS 235 Physics I (A,L). *Corequisite: MTH 201.* Calculus-based introductory physics. Introduces the fundamentals of mechanics from kinematics to Newton's laws, energy, momentum and their conservation laws, rotational and harmonic motions, then statics and equilibrium. Experiments explore the topics covered in the lectures. Three hours of lecture and three hours of lab per week. *4 Cr. Fall*

PHS 240 Physics II (A,L). *Prerequisites: PHS 235; corequisite: MTH 202.* Calculus- based introductory physics. Introduces fluids, waves and wave propagation; thermodynamics, kinetic theory of gases, and the first and second laws of thermodynamics; and the fundamentals of electricity and magnetism, including fields and potentials, electric circuits, and Maxwell's equations. Experiments explore the topics covered in the lectures. Three hours of lecture and three hours of lab per week. *4 Cr. Spring.*

PHS 307 Physics III (A). *Prerequisite: PHS 240; corequisite: MTH 203.* The first part of a one-year transition to advanced physics. Discusses topics in classical physics beyond the first-year courses. Includes topics such as complex mechanical systems, statistical thermodynamics, electromagnetic fields, and geometrical optics. Three hours of lecture per week. *3 Cr. Fall.*

PHS 325 Intermediate Physics Laboratory (A). *Corequisite: PHS 307.* Allows students to perform experiments with mechanical and electrical oscillators, Fourier series, statistical mechanics, and the wave properties of sound and light. Provides an introduction to methods of data analysis, such as curve fitting and error propagation. One hour of lecture and three hours of lab per week. *2 Cr. Fall.*

PHS 328 Modern Physics (A). *Prerequisite: PHS 307.* Provides an introduction to the theory of special relativity, quantum physics, atomic and nuclear physics, and elementary particle physics. Three hours of lecture per week. *3 Cr. Spring.*

PHS 332 Mathematical Methods of Physics (A). *Prerequisite: PHS 307; corequisite: MTH 255.* Presents a survey of mathematical methods used in the physical sciences. Includes topics such as vector analysis, linear algebra, differential equations, complex numbers, partial differentiation, vector operators, multiple integrals, and Fourier series. Three hours of lecture per week. *3 Cr. Spring.*

PHS 345 Advanced Physics Laboratory I (A). *Prerequisites: MTH 203, PHS 325, and CHM 205.* Covers the statistical treatment of data, propagation of errors, graphs, and report writing. Requires students to conduct experiments using modern physical measurement techniques, produce written scientific reports, and make oral presentations describing and analyzing the methods and their results. Three hours of lab per week. *1 Cr. Fall.*

PHS 350 Advanced Physics Laboratory II (A). *Prerequisite: PHS 345; corequisite CHM 206.* Students conduct experiments using modern physical measurement techniques, produce written scientific reports, and make oral presentations describing their methods and analyzing their results. Three hours of lab per week. *1 Cr. Spring.*

PHS 353 Classical Mechanics (A). *Prerequisite: PHS 332.* Covers the theory of mechanical systems, including Newton's Laws, conservation principles, the Lagrangian and Hamiltonian formulations, and their applications. Three hours of lecture per week. *3 Cr. Fall.*

PHS 361 Special Topics in Physics (A). *Prerequisites: PHS 328 and PHS 332, or permission of instructor.* Provides an intermediate-level introduction to selected areas of physics. Possible topics include Condensed Matter Physics, Astrophysics, and others. May be taken only once for major credit. Three hours of lecture per week. *3 Cr. Fall.*

PHS 368 Electricity and Magnetism (A). *Prerequisite: PHS 332.* Covers the theory of electromagnetic fields using vector calculus. Includes electrostatic and magnetic fields in vacuum and in matter, time-varying fields, magnetic induction,

Maxwell's Equations and the propagation of electromagnetic waves. May include applications to radiation fields, waveguides, and superconductors. Three hours of lecture per week. *3 Cr. Spring.*

PHS 399 Independent Study in Physics (A). Arranged in consultation with the instructor-sponsor and in accordance with the procedures of the Office of Academic Advisement prior to registration. *1-6 Cr. Three hours per week per credit.*

PHS 403 Physics Project Seminar I (A). *Prerequisite: senior status and permission of instructor.* In-depth investigation of an individual topic in physics with agreement of a faculty mentor. Includes topic and project development and investigation as well as attendance at seminars. One hour of seminar/discussion per week. *1 Cr. Fall.*

PHS 404 Physics Project Seminar II (A). *Prerequisite: PHS 403.* Continuation of PHS 403. Student research culminates in preparation and presentation of a public lecture and poster. Attendance at seminars is also required. One hour of seminar/discussion per week. *1 Cr. Spring.*

PHS 411 Quantum Mechanics (A). *Prerequisites: PHS 328 and PHS 332.* Provides a rigorous introduction to quantum mechanics. Topics include the Schrödinger equation with various potentials, hydrogen-like atoms, spin, and approximation methods. Three hours of lecture per week. *3 Cr. Fall.*

PHS 426 Advanced Theoretical Physics (A). *Prerequisites: PHS 353, PHS 368, and PHS 411.* Explores topics in classical mechanics, electrodynamics, and quantum mechanics beyond those covered in prior classes. Three hours of lecture per week. *3 Cr. Spring.*

PHS 499 Independent Study in Physics (A). Arranged in consultation with the instructor-sponsor and in accordance with the procedures of the Office of Academic Advisement prior to registration. *1-6 Cr. Three hours per week per credit.*

Astronomy

AST 203 Introduction to Astronomy (A,N). *Prerequisite: MTH 112.* An introduction to what we have learned about the solar system, stars, galaxies, and the Universe, as well as what's yet to be discovered. Special topics may include black holes, relativity, dark matter, and extraterrestrial life. Three hours of lecture per week. *3 Cr. Every Semester.*

AST 205 Introduction to Astronomy (w/ lab) (A,L). *Prerequisite: MTH 112.* An introduction to what we have learned about the solar system, stars, galaxies, and the Universe, as well as what's yet to be discovered. Special topics may

include black holes, relativity, dark matter, and extraterrestrial life. Lab section provides for observation, both with the unaided eye and telescopes, and will use the College planetarium to illustrate some concepts. Three hours of lecture and three hours of lab per week. *4 Cr. Every Semester.*

AST 399 Independent Study in Astronomy (A). Arranged in consultation with the instructor-sponsor and in accordance with the procedures of the Office of Academic Advisement prior to registration. *1-6 Cr. Three hours per week per credit.*

AST 499 Independent Study in Astronomy (A). Arranged in consultation with the instructor-sponsor and in accordance with the procedures of the Office of Academic Advisement prior to registration. *1-6 Cr. Three hours per week per credit.*

The information in this publication was current as of June 2007 when the text was compiled. Changes, including but not restricted to, tuition and fees, course descriptions, degree and program requirements, policies, and financial aid availability may have occurred since that time. Whether or not a specific course is scheduled for a given term is contingent on enrollment, budget and staffing. The college reserves the right to make any changes it finds necessary and may announce such changes for student notification in publications other than the College catalogs. For the purpose of degree and program completion, students are bound by the requirements in effect as stated in the printed catalog at the time of their matriculation at SUNY Brockport. Inquiries on the current status of requirements can be addressed to the appropriate College department of office. Also refer to the Brockport Web site home page at www.brockport.edu for current information.