

# Physics

## Department Information

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Department of Physics website  
<https://www.southalabama.edu/physics/>

The curriculum in the Department of Physics serves three groups of students: those preparing for careers in physics, those pursuing professional fields such as medicine and engineering, and those electing physics and astronomy as part of the natural science requirement for Bachelor of Arts or Bachelor of Science Degrees. The degree program in physics allows for flexibility to the extent that the serious student can select related courses in biology, chemistry, geology, computer science, and engineering to prepare for a career in such interdisciplinary areas as biophysics, geophysics, oceanography, and environmental science. Three options for a Bachelor of Science degree in Physics are offered. One option (the Premedical Option) is for those students pursuing medicine as a career. Links to sample programs and requirements for each option are given in the degree General Comments sections of each Area of Study. Students pursuing a degree in Physics also must have a minor in another discipline. In addition, the Department of Physics offers a double major with the Meteorology program within the Department of Earth Sciences.

All first-time freshmen must successfully complete CAS 100: First Year Experience, as a degree requirement. Students must enroll during their first term at USA, except for summer-entry students who must enroll in the fall semester following entry.

The Physics Pre-Medical Option requires a minimum of 129 hours, while the other Physics options require a minimum of 120 hours.

## Areas Of Study

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Minor in Physics  
Physics (BS) - General Physics  
Physics (BS) - Graduate School Prep  
Physics (BS) - Meteorology Double Major  
Physics (BS) - Premedical Option

## Courses

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### Physics (PH)

**PH 101L Introduction to Astronomy Lab 0 cr**  
Laboratory course for the Introduction to Astronomy course. Student must pass this laboratory course to receive a passing grade in the PH 101 course. Students must take PH 101L concurrently with PH 101 and pass the lab. The PH 101L grade is a component of the PH 101 course grade. Co-requisite: PH 101

**PH 104L Concepts of Physics Laboratory 0 cr**  
Laboratory course for the Concepts of Physics course. Student must pass this laboratory course to receive a passing grade in the PH 104 course. Students must take PH 104L concurrently with PH 104 and pass the lab. The PH 104L grade is a component of the PH 104 course grade. Co-requisite: PH 104

**PH 114L Alg-Trig Based Physics I Lab 0 cr**  
Laboratory course for the first semester of a two-semester introductory sequence in algebra/trigonometry-based physics. Student must pass this laboratory course to receive a passing grade in the PH 114 course. Students must take PH 114L concurrently with PH 114 and pass the lab. The PH 114L grade is a component of the PH 114 course grade. Co-requisite: PH 114

**PH 115L Alg-Trig Based Physics II Lab 0 cr**  
Laboratory course for the second semester of a two-semester introductory sequence in algebra/trigonometry-based physics. Student must pass this laboratory course to receive a passing grade in the PH 115 course. Students must take PH 115L concurrently with PH 115 and pass the lab. The PH 115L grade is a component of the PH 115 course grade. Co-requisite: PH 115

**PH 201L Calculus-Based Physics I Lab 0 cr**

Laboratory course for the first semester of a two-semester introductory sequence in calculus-based physics. Student must pass this laboratory course to receive a passing grade in the PH 201 course. Students must take PH 201L concurrently with PH 201 and pass the lab. The PH 201L grade is a component of the PH 201 course grade. Co-requisite: PH 201

**PH 202L Calculus-Based Physics II Lab 0 cr**

Laboratory course for the second semester of a two-semester introductory sequence in calculus-based physics. Student must pass this laboratory course to receive a passing grade in the PH 202 course. Students must take PH 202L concurrently with PH 202 and pass the lab. The PH 202L grade is a component of the PH 202 course grade. Co-requisite: PH 202

**PH 303L Modern Physics Lab 0 cr**

Laboratory course for the Modern Physics Course. Students must take PH 303L concurrently with PH 303 and pass the lab. The PH 303L grade is a component of the PH 303 course grade. Co-requisite: PH 303

**PH 385L Experimental Physics Lab 0 cr**

Laboratory course for the Experimental Physics course. Students must take PH 385L concurrently with PH 385 and pass the lab. The PH 385L grade is a component of the PH 385 course grade. Co-requisite: PH 385

**PH 101 Introduction to Astronomy 4 cr**

This is a descriptive survey course of elementary astronomy with laboratory intended for both non-science and science majors. Topics covered include a description of the celestial sphere, a tour of the Solar System, techniques for measuring and classifying stars, stellar evolution, white dwarfs, black holes, neutron stars, galaxies, and Big Bang cosmology. Students must take PH 101L concurrently and pass the lab. The PH 101L grade is a component of the PH 101 course grade. Fee. Core course. Co-requisite: PH 101L

**PH 104 Concepts of Physics 4 cr**

A descriptive overview of the entire field of physics with laboratory, including the concepts of scalars and vectors. Newton's law, momentum and energy conservation, rotational motion, fluids, heat and thermodynamics, sound, electricity and magnetism, optics, atomic and nuclear physics, relativity, and elementary particle physics. This course is intended to provide the non-scientist with substantial insight into the physical behavior of matter and energy. Extensive demonstrations accompany the presentation of material to illustrate key concepts. Fee. Students must take PH 104L concurrently and pass the lab. The PH 104L grade is a component of the PH 104 course grade. Core course. Co-requisite: PH 104L

**PH 107 Contemporary Topics in Physics 1 cr**

Intended for physics majors in their first year or others interested in physics as a possible major. This course will survey current "hot topics" in physics, basic useful techniques in physics problem-solving, physics as a career, and research in physics at USA. This course is not intended to satisfy the science requirements within the College of Arts & Sciences.

**PH 114 Physics with Algebra-Trig I 5 cr**

First semester of a two-semester introductory course in algebra/trigonometry-based physics with laboratory and recitation. This course covers mechanics and thermodynamics: one- and two-dimensional motion, vectors, Newton's laws of motion, work and energy, momentum and collisions, circular motion, rotational motion, properties of solids and fluids, the laws of thermodynamics, kinetic theory of matter, simple harmonic motion, and wave motion. The laboratory uses computerized data acquisition and analysis for most of the experiments. Students must take PH 114L concurrently and pass the lab. The PH 114L grade is a component of the PH 114 course grade. Fee. Core course. Co-requisite: PH 114L  
Pre-requisite: ACT Math 25 or MA 113 Minimum Grade of D or MA 115 Minimum Grade of D or MA 125 Minimum Grade of D or MA 120 Minimum Grade of D.

**PH 115 Physics with Algebra -Trig II 5 cr**

Second semester of a two-semester introductory course in algebra/trigonometry-based physics with laboratory and recitation. This course covers electrostatics, DC circuits, RC circuits, magnetic fields and forces, Faraday's Law, AC circuits, geometrical optics, interference and diffraction of light, the special theory of relativity, quantum physics, and atomic and nuclear physics. The laboratory uses computerized data acquisition and analysis for most of the experiments. Students must take PH 115L concurrently and pass the lab. The PH 115L grade is a component of the PH 115 course grade. Fee. Core course. Co-requisite: PH 115L  
Pre-requisite: PH 114 Minimum Grade of D.

**PH 194 Dir St - Variable Content Lab 1 cr**

A directed studies course to substitute for a laboratory credit for students who have successfully completed an introduction to astronomy or concepts of physics course at another university without the laboratory. Students taking this course must get the approval of the Physics Department Chair. This course may be taken up to two times (once for each course). Fee.

**PH 201 Calculus-Based Physics I 4 cr**

First semester of a two-semester introductory course in calculus-based physics with recitation and laboratory. This course covers: one and two-dimensional motion, vectors, Newton's laws of motion and their applications, work and energy, momentum and collisions, circular motion, rotational motion, properties of materials, simple harmonic motion, wave motion and topics in thermodynamics. The laboratory uses computerized data and analysis for most of the experiments. Core course.  
Co-requisite: MA 126, PH 201L  
Pre-requisite: MA 125 Minimum Grade of D and (EH 101 Minimum Grade of C or ACT English 27 or SAT Critical Reading 610 or ELPT 33 ).

**PH 202 Calculus-Based Physics II 4 cr**

Second semester of a two-semester introductory course in calculus-based physics with laboratory. This course covers electrostatic fields and Gauss' law, electric potential, electric circuits, magnetic fields, Ampere's law, Faraday's law, inductance, Maxwell's equations, electromagnetic waves and optics. The laboratory uses computerized data acquisition and analysis for most of the experiments. Students must take PH 202L concurrently and pass the lab. The PH 202L grade is a component of the PH 202 course grade. Fee. Core course.  
Co-requisite: PH 202L  
Pre-requisite: PH 201 Minimum Grade of D and MA 126 Minimum Grade of D and (EH 101 Minimum Grade of C or ACT English 27 or SAT Critical Reading 610 or ELPT 33 ).

**PH 290 Special Topics- 1 TO 4 cr**

Topics of current interest but not available in regularly scheduled sophomore level courses. This course may be repeated once for credit when the content varies and may be taken twice for up to eight hours.

**PH 294 Dir St - Variable Content Lab 1 cr**

A directed studies course to substitute for a laboratory credit for students who have successfully completed a calculus or algebra-based physics lecture course at another university without the laboratory. Students taking this course must get the approval of the Physics Department Chair. This course may be taken up to two times (once for each of the missing laboratories). Prerequisite: Permission of the Department Chair  
Pre-requisite: EH 101 Minimum Grade of C.

**PH 301 Introductory Astrophysics 3 cr**

Application of the principles of physics to the study of astronomical phenomena. Topics include celestial mechanics, stars and stellar evolution, the Milky Way and other galaxies, and cosmological models. Prior knowledge of astronomy is not required.  
Pre-requisite: PH 115 Minimum Grade of D or PH 202 Minimum Grade of D and MA 125 Minimum Grade of D.

**PH 303 Modern Physics 4 cr**

This course, with laboratory, surveys physics of the twentieth century. Topics covered include special relativity, wave-particle concepts, the Schroedinger equation and quantum theory of the hydrogen atom, atomic spectra and structure, molecular spectra, the solid state, nuclear structure, radioactivity, and elementary particles. The accompanying laboratory includes experimental investigations of important topics in the subject of Modern Physics. Computerized numerical and graphical analysis of data is extensively used in the laboratory. Laboratory reports are written with word processors and submitted in a format consistent with articles submitted to student research journals. Students must take PH 303L concurrently and pass the lab. The PH 303L grade is a component of the PH 303 course grade.  
Co-requisite: PH 303L  
Pre-requisite: PH 303L and MA 125 Minimum Grade of D and PH 202 Minimum Grade of D or PH 115 Minimum Grade of D. PH 303L can be taken concurrently with this course.

**PH 311 Condensed Matter Physics 3 cr**

This is an introductory course which covers modern condensed matter physics. Topics include crystal structure and properties; electronic structure of insulators, semiconductors and metals; and phenomena of current research interest and technological relevance. Methods used to measure and analyze these phenomena will also be discussed.  
Pre-requisite: PH 303 Minimum Grade of D.

**PH 346 Classical and Modern Optics 3 cr**

Wave motion, reflection, refraction, dispersion, diffraction, interference phenomena, Fourier spectroscopy, lasers and other modern applications of optics.  
Pre-requisite: PH 202 Minimum Grade of D and MA 125 Minimum Grade of D.

**PH 348 Electricity and Magnetism I 3 cr**

First of two-semester sequence in electromagnetism. Topics include a review of vector analysis, Coulomb's law, Gauss' law, calculation of the scalar potential, electric fields in matter, the Biot-Savart law, Ampere's law, the vector potential, magnetostatics in matter, electrodynamics, Faraday's law, inductance, Maxwell's correction to Ampere's law and Maxwell's equations.  
Pre-requisite: MA 227 Minimum Grade of D and PH 202 Minimum Grade of D or PH 115 Minimum Grade of D.

**PH 349 Electricity and Magnetism II 3 cr**

Second of two-semester sequence in electromagnetism. Topics include electromagnetic wave propagation in free space, electromagnetic wave propagation in materials, reflection and transmission at interfaces, wave guides, electromagnetic radiation, optical dispersion, and electrodynamics extended to the special theory of relativity  
Pre-requisite: PH 348 Minimum Grade of D.

**PH 354 Electronics 3 cr**

This course is intended to provide a theoretical and practical background in electronics. Topics include AC circuits, diode circuits, single-stage amplifiers, op-amps and feedback, and digital electronics. This course is not intended to satisfy the technical elective requirements for Electrical Engineering. The course will include periodic laboratory work.

Pre-requisite: MA 126 Minimum Grade of D and PH 202 Minimum Grade of D or PH 115 Minimum Grade of D.

**PH 366 Physical Mechanics I 3 cr**

First course in a two-semester sequence in classical mechanics. Topics include motion of particles in one-dimension, one-dimensional motion theorems, harmonic oscillations, damped oscillations, forced oscillations, kinematics in multiple dimensions, momentum and energy theorems, the central force problem, motion under inverse square law forces, planetary orbital motion, Rutherford scattering, conservation theorems for multi-particle systems and their applications, collisions, coupled-harmonic oscillators, and rigid body rotation about a fixed axis.

Pre-requisite: MA 227 Minimum Grade of D and PH 202 Minimum Grade of D.

**PH 367 Physical Mechanics II 3 cr**

Second course in a two-semester sequence in classical mechanics. Topics include: moving and rotating coordinate systems. Lagrange's equation and applications, Hamiltonian formulation, inertia and stress tensors, rotations of rigid bodies and the theory of small oscillations.

Pre-requisite: PH 366 Minimum Grade of D.

**PH 385 Experimental Physics - W 3 cr**

A course in the methods and techniques of experimental physics. A number of experiments in the area of classical mechanics, atomic physics, molecular physics, and nuclear physics will be performed and analysis is required. Computerized numerical and graphical analysis of data is extensively used in the laboratory. Laboratory reports are written with word processors and submitted in a format consistent with articles submitted to a student research journal. Students must take PH 385L concurrently and pass the lab. The PH 385L grade is a component of the PH 385 course grade.

Co-requisite: PH 385L

Pre-requisite: PH 385L and PH 303 Minimum Grade of D. PH 385L and PH 303 can be taken concurrently with this course.

**PH 390 Special Topics - 1 TO 3 cr**

Topics of current interest not available in a regularly scheduled course. This course may be repeated once for credit and may be taken for up to six hours credit.

**PH 411 Computational Methods in Phys 3 cr**

Use of computers in physics research (industrial, applied, or basic) is now common. This course will introduce advanced undergraduate physics students to computer solutions of physics problems. Particular attention will be paid to problems that have no analytic solutions and may only be solved numerically. This course will introduce several numeric methods and apply them to specific problems from quantum mechanics, electrodynamics, and mechanics. Students will write a series of programs in the Fortran or the C programming language and use them to solve undergraduate level physics problems.

Pre-requisite: PH 303 Minimum Grade of D and MA 238 Minimum Grade of D and CIS 210 Minimum Grade of D or CIS 227 Minimum Grade of D.

**PH 448 Elementary Quantum Mechanics I 3 cr**

The first course of a two-semester sequence in Quantum Mechanics. Topics include an introduction to Hilbert space and operators, the quantum state and observables, the Heisenberg uncertainty principle, time evolution of the quantum state, application of the Schrodinger equation to one-dimensional systems, and the solution of the hydrogen atom.

Pre-requisite: MA 238 Minimum Grade of D and PH 303 Minimum Grade of D or CH 302 Minimum Grade of D.

**PH 449 Elementary Quantum Mechanic II 3 cr**

The second course of two-semester sequence in Quantum Mechanics. Topics include a continuation in the mathematical formulation of quantum mechanics, angular momentum, perturbation theory, identical particles and spin, collision theory, and the semi-classical treatment of radiation. This course is recommended for students anticipating graduate study in physics.

Pre-requisite: PH 448 Minimum Grade of D.

**PH 463 Thermodynamics-Stat Mechanics 3 cr**

An in-depth course in thermodynamics and statistical mechanics. Topics include simple thermodynamics systems, work, heat and the first law of thermodynamics, ideal gases, the second law of thermodynamics, entropy, enthalpy, Helmholtz and Gibbs functions, TdS equations, heat capacity, partition function, equipartition of energy, statistical distribution of molecular speeds, thermal properties of solids, higher order phase transitions, chemical equilibrium, Thomson effect, Bose-Einstein statistics, Nuclear Magnetism, and the third law of thermodynamics.

Pre-requisite: PH 202 Minimum Grade of D and MA 227 Minimum Grade of D.

**PH 494 Directed Studies - 1 TO 3 cr**

PH 494 Directed Studies 1-3 cr Directed research under the supervision of a faculty member. Topics generally coincide with the research interest of the supervising faculty member. Pre-requisite: Permission of the Physics department chair. May be taken three times for up to 9 hours.

**PH 499 Senior Thesis-Honors - H 6 cr**

A written thesis that is part of the Honors Senior Project which is submitted to partially satisfy the requirements for a Degree in Physics with distinction. The Senior Thesis will be written on research done in collaboration with an Honors Physics Faculty member in the Junior/ Senior year. The Senior Thesis will be reviewed by a committee of Honors Physics Faculty. Upon approval by the committee the Senior Honors candidate will present the Senior Thesis at Honors Student Colloquium. This course may be repeated once for credit. Prerequisite: The Honors candidate must have developed in the last semester of the previous year a prospectus with the Physics Faculty Mentor and presented this prospectus at the Annual Honors Student Colloquium, also permission of the Department Chair.

Pre-requisite: EH 102 Minimum Grade of C.

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## Faculty

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BOLEMAN, MICHAEL W.

Senior Instructor  
BS, University of West Georgia  
MS, University of Kentucky

COCHRAN, MELANIE R.

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BS, University of Southern Miss  
MS, University of Southern Miss

DAHAL, ARJUN P.

Assistant Professor  
MS, University of Minnesota-Duluth  
PHD, University of South Florida

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Assistant Professor  
BS, Emory University  
PHD, Baylor University

GAPUD, ALBERT A.

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BS, University of Kansas  
PHD, University of Kansas

GODANG, ROMULUS

Professor  
BS, University of North Sumatra  
MS, Virginia Polytechnic Inst and  
PHD, Virginia Polytechnic Inst and

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BS, Hebei University  
MS, Hebei University  
PHD, University of Virginia

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PHD, Florida State University

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PHD, Kansas State University