

PHYSICS

(413) 662-5455

Chairperson: Emily Maher, Ph.D.

Email: Emily.Maher@mcla.edu

PROGRAMS AVAILABLE

BACHELOR OF ARTS IN PHYSICS

BACHELOR OF SCIENCE IN PHYSICS

PHYSICS MINOR

TEACHING LICENSURE

PHYSICS MAJOR PROGRAM

The Department of Physics offers a four-year program leading to a Bachelor of Arts or Science in physics. Students study basic physical laws of nature, apply these laws in the laboratory, and explore practical applications found in society. Opportunities are available for advanced study in electronics, optics, solid state physics, computer applications, and elementary particle physics. Upon graduation, students are prepared to enter graduate school in physics or related scientific and engineering fields or to enter directly into the scientific or technological community. An undergraduate degree in physics is also an excellent foundation for graduate work in a host of other fields.

Students graduating with a degree in physics will be able to:

- Understand the basic principles in the various fields of physics.
- Make connections between various fields of physics.
- Solve problems using math and physical reasoning.
- Use modern computational methods to analyze and present data.
- Design and conduct experiments to evaluate ideas and verify theory.
- Evaluate the validity of experimental evidence.
- Effectively communicate information gained by written and oral means.

PHYSICS MAJOR

Requirements

The physics program requires students to complete particular courses to meet their core curriculum requirements and to satisfy prerequisites for physics courses or to provide evidence of competency in these areas.

Bachelor of Arts:

MATH	150	Precalculus	3 cr
MATH	220	Calculus I	3 cr
MATH	320	Calculus II	3 cr
MATH	330	Calculus III	3 cr
PHYS	151	Introduction to Mechanics	4 cr
PHYS	200	Seminar for Physics Majors	1 cr
PHYS	251	Introduction to Electricity and Magnetism	4 cr
PHYS	252	Introduction to Waves, Optics, and Relativity	4 cr
PHYS	301	Classical Mechanics	3 cr
PHYS	303	Electricity and Magnetism	3 cr
PHYS	351	Modern Physics	4 cr
PHYS	361	Mathematical Physics	3 cr
PHYS	401	Advanced Physics Laboratory I	3 cr
PHYS	402	Advanced Physics Laboratory II	3 cr
PHYS	471	Quantum Mechanics	3 cr

TOTAL PHYSICS BACHELOR OF ARTS **47 cr**

Bachelor of Science:

MATH	150	Precalculus	3 cr
MATH	220	Calculus I	3 cr
MATH	320	Calculus II	3 cr
MATH	330	Calculus III	3 cr

MATH	380	Differential Equations	3 cr
OR MATH	430	Calculus IV	
PHYS	151	Introduction to Mechanics	4 cr
PHYS	200	Seminar for Physics Majors	1 cr
PHYS	251	Introduction to Electricity and Magnetism	4 cr
PHYS	252	Introduction to Waves, Optics, and Relativity	4 cr
PHYS	301	Classical Mechanics	3 cr
PHYS	303	Electricity & Magnetism	3 cr
PHYS	305	Electronics	3 cr
PHYS	351	Modern Physics	4 cr
PHYS	361	Mathematical Physics	3 cr
PHYS	401	Advanced Physics Laboratory I	3 cr
PHYS	402	Advanced Physics Laboratory II	3 cr
PHYS	471	Quantum Mechanics	3 cr
Plus three Physics courses 300 level or higher			9 cr

TOTAL PHYSICS BACHELOR OF SCIENCE **62 cr**

PHYSICS MINOR PROGRAM

Students who minor in physics will obtain a firm foundation in both scientific techniques and physical content. In addition to a comprehensive study of the major area of physics, the student will gain a depth of knowledge in specific fields through study in upper-division courses.

PHYSICS MINOR

Requirements

PHYS	151	Introduction to Mechanics	4 cr
PHYS	251	Introduction to Electricity and Magnetism	4 cr
PHYS	252	Introduction to Waves, Optics, and Relativity	4 cr
PHYS	351	Modern Physics	4 cr
Plus two Physics courses level 300 or higher			8 cr

PHYS 120 Introduction to Engineering 4 cr

Introduces students to basic scientific methodology, current problems and fundamental principles of engineering design. Intended for nonscience majors and potential engineering students. Required laboratory introduces fundamental science and engineering principles through collaborative projects such as robotics. Required laboratory. Course attributes: CSTL.

Prerequisite: None

PHYS 131 General Physics I 4 cr

This is the first of a two-semester sequence, designed primarily for students in the biological and health sciences and others who desire a rigorous but non-calculus-based course that presents a complete introduction to physics.

Covers vectors, one and two dimensional motion, Newton's laws, and rotational motion, conservation of energy and momentum, gravitation, wave motion, sound, heat and thermodynamics. Required laboratory. Course attributes: CSTL.

Prerequisite: None

PHYS 132 General Physics II 4 cr

This is the second of a two-semester sequence, designed primarily for students in the biological and health sciences and others who desire a rigorous but non-calculus-based course that presents a complete introduction to physics. Covers geometrical optics, electricity and magnetism, electronics, modern physics, relativity. Required laboratory. Course attributes: CSTL.

Prerequisite: PHYS 131

PHYS 140 Astronomy 3 cr

Looks at historical and modern aspects of astronomy. Topics covered will include: the Earth-Moon system, our solar system, galaxies, the observable universe, as well as current research in astronomy, including quasars, pulsars,

black holes, other planetary systems and the search for extraterrestrial life.

Course attributes: CST.

Prerequisite: None

PHYS 151 Introduction to Mechanics 4 cr

First course in a three-course introductory physics sequence which utilizes a calculus-based approach to study the natural world. This course focuses on kinematics, dynamics, conservation of energy and momentum, and rotational motion. Required Laboratory. Course attributes: CSTL.

Prerequisite: MATH 150 or MATH 220

PHYS 200 Seminar for Physics Majors 1 cr

Explores the discipline of physics in order to support majors in their academic work and help them understand their career options. Explores the diversity of fields within physics through presentations, reading and writing activities and interactions with peers and mentors. This seminar is required for all MCLA physics majors.

Prerequisite: None

PHYS 251 Introduction to Electricity & Magnetism 4 cr

Second course in a three-course introductory physics sequence which utilizes a calculus-based approach to study the natural world. This course focuses on electricity and magnetism, including Maxwell's Laws. Required Laboratory. Course attributes: CSTL.

Prerequisite: PHYS 151, MATH 220

PHYS 252 Introduction to Waves, Optics, and Relativity 4 cr

Third course in a three-course introductory physics sequence which utilizes a calculus-based approach to study the natural world. This course focuses on waves, optics, and special relativity. Required Laboratory.

Prerequisite: PHYS 251, MATH 320

multiple integrals: applications of integration, vector analysis, ordinary and partial differential equations, coordinate transformations and tensor analysis, and probability.

Prerequisite: MATH 320

PHYS 401 Advanced Physics Laboratory I 3 cr

Studies laboratory techniques to supplement senior physics courses or work on special projects with departmental approval. Use of current computer technology is integral.

Prerequisite: PHYS 252

PHYS 402 Advanced Physics Laboratory II 3 cr

Continues Physics 401. Use of current computer technology is integral.

Prerequisite: PHYS 401

PHYS 403 Introduction to Particle Physics 3 cr

Introduces the concepts necessary to understand the structure of matter at the most fundamental level. Considers matter in terms of its most elementary constituents, and discusses the properties, classifications, and forces which act on these particles. Discusses the relationship between conservation laws and symmetries. The experimental study of elementary particles is discussed throughout the course. Concludes with a discussion of outstanding questions in the field.

Prerequisite: PHYS 351

PHYS 404 Introduction to Solid State Physics 3 cr

Provides an introduction to the physics of solids. Students will characterize the properties of static (crystal structure) and dynamic (lattice vibrations) arrangements of atoms. Students will study electrons in solids and identify key features distinguishing metals, insulators and semiconductors.

