

# PHYSICS

## Contact Information

### Division

Sciences and Mathematics

### Dean

Heather Roberts

### Associate Dean

Karen Warburton

### Division Office

V 211, Rocklin Campus

## Overview

The Physics Department offers coursework satisfying the needs of students wishing to transfer to four-year colleges and other institutions for further study in science and engineering. Those students wishing a basic background in Physics for study in the many fields based upon science and careers in teaching, medicine, agriculture and other sciences will also find coursework.

TRANSFER MAJOR REQUIREMENTS in Physics are available in the Counseling Center. In all cases, students should consult with a counselor for specific transfer requirements. Four-year graduates in Physics are qualified for positions in research, teaching, engineering, medicine and industry.

## Faculty

### Dominic Calabrese

#### Professor, Physics

B.S., DePaul University

M.S., University of Nebraska, Lincoln

Ph.D., University of Nebraska, Lincoln

### Donald C. Harris

#### Professor, Physics

B.S., Ohio State University

Ph.D., Ohio State University

### Aviva Shackell

#### Professor, Physics

B.S., University of California, Santa Barbara

Ph.D., University of California, Los Angeles

## Degrees/Certificates

### Associate Degree for Transfer

- Physics for Transfer (p. 1)

### Associate Degree

- Physics (p. 2)

## Physics for Transfer

### AS-T Degree

Physics is a program that provides students of diverse abilities and needs rigorous preparation that affords them opportunities to develop the technical, analytical and critical thinking skills necessary to achieve their wide ranging goals and become lifelong learners. Program curriculum

introduces students to the fundamental principles that govern the nature of interactions in the physical world. The curriculum strongly emphasizes both the theoretical and experimental fundamentals in physics. Successful completion of the curriculum in physics prepares the student for transfer to four-year colleges and universities.

The Associate in Science in Physics for Transfer degree (AS-T) prepares students to transfer into the CSU system to complete a bachelor's degree in Physics or a major deemed similar by a CSU campus. Students earning an associate degree for transfer and meeting the CSU minimum transfer admission requirements are guaranteed admission with junior standing to the CSU system, but not to a particular campus or major. Upon transfer, students will be required to complete no more than 60 additional prescribed units to earn a bachelor's degree.

To earn the Associate in Science in Physics for Transfer degree, students must complete 60 CSU-transferable semester units with a minimum grade point average of 2.0, including both of the following:

- completion of all courses required for the major with grades of "C" or better; and
- completion of the California State University General Education Breadth (CSU GE) (<http://catalog.sierracollege.edu/archive/2016-2017/student-resources/general-education/california-state-university-general-education-breadth-requirements>) pattern or the Intersegmental General Education Transfer Curriculum (IGETC) (<http://catalog.sierracollege.edu/archive/2016-2017/student-resources/general-education/intersegmental-general-education-transfer-curriculum-igetc>) pattern. (Students transferring to a CSU campus using IGETC must complete Area 1C Oral Communication to be eligible for admission.)

It is highly recommended that, prior to transferring, students complete courses that satisfy the CSU United States History, Constitution and American Ideals graduation requirement. In all cases, students should consult with a counselor for more information on university admission and transfer requirements.

**RESTRICTION:** International coursework from non-United States regionally accredited institutions cannot be applied to associate degrees for transfer.

### Required Courses

PHYS 0205	Principles of Physics: Mechanics	4
PHYS 0205L	Principles of Physics Laboratory: Mechanics	1
PHYS 0210	Principles of Physics: Electricity and Magnetism	3
PHYS 0210L	Principles of Physics Laboratory: Electricity and Magnetism	1
PHYS 0215	Principles of Physics: Heat, Waves and Modern Physics	3
PHYS 0215L	Principles of Physics Laboratory: Heat, Waves and Modern Physics	1
MATH 0030	Analytical Geometry and Calculus I	4
MATH 0031	Analytical Geometry and Calculus II	4
MATH 0032	Analytical Geometry and Calculus III	4
Total Units		25

**Additional Recommended Preparation**

While these courses are not required for this degree, completion of these courses will better prepare students for upper-division physics courses.

MATH 0033	Differential Equations and Linear Algebra	6
CSCI 0024S	Programming for Mathematics and Science	3
CHEM 0001A	General Chemistry I	5

**Physics****AS Degree**

The Physics major recognizes a concentration in the field of Physics. Successful completion of the curriculum in Physics and the associated electives prepare Physics students for transfer to four-year colleges or universities. In all cases, students should consult with a counselor for more information on university admission and transfer requirements. Students must fulfill the following major requirements with grades of "C" or better, complete a minimum of 60 degree-applicable semester units (12 of which must be completed at Sierra College) with a grade point average of at least 2.0 and complete one of the following three general education patterns:

- Sierra College Associate Degree Requirements (<http://catalog.sierracollege.edu/archive/2016-2017/student-resources/general-education/associate-degree-requirements>) ;
- California State University General Education Breadth (<http://catalog.sierracollege.edu/archive/2016-2017/student-resources/general-education/california-state-university-general-education-breadth-requirements>) pattern;
- Intersegmental General Education Transfer Curriculum (IGETC) (<http://catalog.sierracollege.edu/archive/2016-2017/student-resources/general-education/intersegmental-general-education-transfer-curriculum-igetc>) .

**Required Courses**

PHYS 0205	Principles of Physics: Mechanics	4
PHYS 0205L	Principles of Physics Laboratory: Mechanics	1
PHYS 0210	Principles of Physics: Electricity and Magnetism	3
PHYS 0210L	Principles of Physics Laboratory: Electricity and Magnetism	1
PHYS 0215	Principles of Physics: Heat, Waves and Modern Physics	3
PHYS 0215L	Principles of Physics Laboratory: Heat, Waves and Modern Physics	1

**Select 12-14 units from the following:** 12-14

MATH 0030	Analytical Geometry and Calculus I	
MATH 0031	Analytical Geometry and Calculus II	
MATH 0032	Analytical Geometry and Calculus III	
MATH 0033	Differential Equations and Linear Algebra	

Total Units 25-27

**Recommended Electives**

CHEM 0001B	General Chemistry II	5
CHEM 0005	Chemistry - Quantitative Analysis	4
ENGR 0017	Introduction to Circuit Theory	3

ENGR 0017L	Circuit Theory Laboratory	1
ENGR 0035	Statics	3
ENGR 0045	Materials Science	3
CIS 0050	Applying Computer Software	3
CIS 0070	Word Processing-Beyond the Basics	3
CIS 0080	Spreadsheets in a Business Environment	3
CIS 0090	Database Management	3

**Courses**

Understanding course descriptions (<http://catalog.sierracollege.edu/archive/2016-2017/student-resources/course-information/understanding-course-descriptions>)

**PHYS 0000A. Foundations of College Physics**

*Units: 3*

Prerequisite: Completion with grade of "C" or better or concurrent enrollment in MATH 8

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 lecture

Intended to prepare students for PHYS 105 and 205. Focuses on measurement, relevant mathematical concepts, problem-solving, and a variety of concepts in physics. (not transferable)

**PHYS 0010. Basic Concepts in Physics**

*Units: 3*

Prerequisite: Completion of MATH A with grade of "C" or better

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 lecture

Introduction to the laws of motion, properties of matter, heat, sound, electricity, magnetism, light, atomic and nuclear physics, and relativity. Emphasis is on familiar phenomena in everyday life. Intended for nonscience majors. (CSU, UC-with unit limitation)

**PHYS 0010L. Basic Concepts in Physics Laboratory**

*Unit: 1*

Formerly known as PHYS 0011

Prerequisite: Completion with grade of "C" or better or concurrent enrollment in PHYS 10

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 laboratory

An optional laboratory course taken in conjunction with PHYS 10. Integrates abstract concepts from PHYS 10 into concrete applications through experimentation. Topics include the SI system of measurement; motion; fluids and properties of matter; thermodynamics; waves; sound; electricity and magnetism; and light and optics. (CSU, UC-with unit limitation)

**PHYS 0028. Independent Study**

*Units: 1-3*

Designed for students interested in furthering their knowledge at an independent study level in an area where no specific curriculum offering is currently available. Independent study might include, but is not limited to, research papers, special subject area projects, and research projects. See Independent Study page in catalog. (CSU, UC-with unit limitation)

**PHYS 0105. General Physics I***Units: 4*

Formerly known as PHYS 2A (PHYS 105 and 105L, combined)

Prerequisite: Completion of MATH 8 or equivalent with grade of "C" or better

Corequisite: Concurrent enrollment in PHYS 105L

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 72 lecture

Noncalculus introduction to the principles of mechanics, properties of matter and heat. Emphasis on applications relevant to several majors, including premedical, pre dental, optometry, forestry, architecture, and biological science. (combined with PHYS 105L, C-ID PHYS 105) (CSU, UC-with unit limitation)

**PHYS 0105L. General Physics I Laboratory***Unit: 1*

Formerly known as PHYS 2A (PHYS 105 and 105L, combined)

Prerequisite: Completion of MATH 8 or high school trigonometry with grade of "C" or better

Corequisite: Concurrent enrollment in PHYS 105

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 laboratory

Laboratory portion of PHYS 105. Noncalculus introduction to the principles of mechanics, properties of matter and heat. Emphasis on applications relevant to several majors, including premedical, pre dental, optometry, forestry, architecture, and biological science. (combined with PHYS 105, C-ID PHYS 105) (CSU, UC-with unit limitation)

**PHYS 0110. General Physics II***Units: 4*

Formerly known as PHYS 2B (PHYS 110 and 110L, combined)

Prerequisite: Completion of PHYS 105 and 105L with grades of "C" or better

Corequisite: Concurrent enrollment in PHYS 110L

Hours: 72 lecture

Noncalculus introduction to the principles of waves, sound, light, electricity, magnetism, and modern physics. Emphasis on applications relevant to several majors, including premedical, pre dental, optometry, forestry, architecture, and biological science. (combined with PHYS 110L, C-ID PHYS 110) (CSU, UC-with unit limitation)

**PHYS 0110L. General Physics II Laboratory***Unit: 1*

Formerly known as PHYS 2B (PHYS 110 and 110L, combined)

Prerequisite: Completion of PHYS 105 and 105L with grades of "C" or better

Corequisite: Concurrent enrollment in PHYS 110

Hours: 54 laboratory

Laboratory portion of PHYS 110. Noncalculus introduction to the principles of waves, sound, light, electricity, magnetism, and modern physics. Emphasis on applications relevant to several majors, including premedical, pre dental, optometry, forestry, architecture, and biological science. (combined with PHYS 110, C-ID PHYS 110) (CSU, UC-with unit limitation)

**PHYS 0205. Principles of Physics: Mechanics***Units: 4*

Formerly known as PHYS 4A (PHYS 205 and 205L, combined)

Prerequisite: Completion of MATH 30 and 31 with grades of "C" or better (MATH 31 may be taken concurrently); AND PHYS A or PHYS 105 and 105L, or high school physics with grade(s) of "C" or better

Corequisite: Concurrent enrollment in PHYS 205L

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 72 lecture

Calculus-based introduction to the principles of kinematics, dynamics, energy, momentum, rotational motion, gravitation and fluids. The Physics 205/210/215 sequence presents the general principles and analytical methods used in physics for physical science and engineering majors. (combined with PHYS 205L, C-ID PHYS 205) (CSU, UC-with unit limitation)

**PHYS 0205L. Principles of Physics Laboratory: Mechanics***Unit: 1*

Formerly known as PHYS 4A (PHYS 205 and 205L, combined)

Prerequisite: Completion of MATH 30 and 31 with grades of "C" or better (MATH 31 may be taken concurrently); AND PHYS A, PHYS 105 and 105L, or high school physics with grade(s) of "C" or better

Corequisite: Concurrent enrollment in PHYS 205

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 laboratory

Laboratory portion of PHYS 205. Calculus-based introduction to the principles of kinematics, dynamics, energy, momentum, rotational motion, gravitation and fluids. The Physics 205/210/215 sequence presents the general principles and analytical methods used in physics for physical science and engineering majors. (combined with PHYS 205, C-ID PHYS 205) (CSU, UC-with unit limitation)

**PHYS 0210. Principles of Physics: Electricity and Magnetism***Units: 3*

Formerly known as PHYS 4B (PHYS 210 and 210L, combined)

Prerequisite: Completion of PHYS 205, PHYS 205L, and MATH 31 with grades of "C" or better

Corequisite: Concurrent enrollment in PHYS 210L

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 lecture

Electrostatics, AC and DC circuits, magnetism, Maxwell's Equations, electromagnetic waves, and the electric and magnetic properties of matter. The 205-210-215 sequence presents general principles and analytical methods used in physics for physical science and engineering majors. (combined with PHYS 210L, C-ID PHYS 210) (CSU, UC-with unit limitation)

**PHYS 0210L. Principles of Physics Laboratory: Electricity and Magnetism***Unit: 1*

Formerly known as PHYS 4B (PHYS 210 and 210L, combined)

Prerequisite: Completion of PHYS 205, PHYS 205L, and MATH 31 with grades of "C" or better

Corequisite: Concurrent enrollment in PHYS 210

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 laboratory

Laboratory portion of PHYS 210. Electrostatics, AC and DC circuits, magnetism, Maxwell's Equations, electromagnetic waves, and the electric and magnetic properties of matter. The 205-210-215 sequence presents general principles and analytical methods used in physics for physical science and engineering majors. (combined with PHYS 210, C-ID PHYS 210) (CSU, UC-with unit limitation)

**PHYS 0210R. Problem Solving for Physics 210***Unit: 1*

Formerly known as PHYS 4Y

Corequisite: Concurrent enrollment in PHYS 210

Hours: 18 lecture

Optional problem solving course to accompany PHYS 210. Includes electric forces and fields, electrical potential, capacitors and dielectrics, magnetism, electromagnetic waves, and DC and AC circuits. (CSU, UC-with unit limitation)

**PHYS 0215. Principles of Physics: Heat, Waves and Modern Physics***Units: 3*

Formerly known as PHYS 4C (PHYS 215 and 215L, combined)

Prerequisite: Completion of PHYS 205, PHYS 205L, and MATH 31 with grades of "C" or better

Corequisite: Concurrent enrollment in PHYS 215L

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 lecture

Thermodynamics, kinetic theory of gases, waves, geometrical and physical optics, sound, and modern physics. The 205-210-215 sequence presents general principles and analytical methods used in physics for physical science and engineering majors. (combined with PHYS 215L, C-ID PHYS 215) (CSU, UC-with unit limitation)

**PHYS 0215L. Principles of Physics Laboratory: Heat, Waves and Modern Physics***Unit: 1*

Formerly known as PHYS 4C (PHYS 215 and 215L, combined)

Prerequisite: Completion of PHYS 205, PHYS 205L, and MATH 31 with grades of "C" or better

Corequisite: Concurrent enrollment in PHYS 215

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 laboratory

Laboratory portion of PHYS 215. Covers topics of thermodynamics, kinetic theory of gases, waves, geometrical and physical optics, sound, and modern physics. (combined with PHYS 215, C-ID PHYS 215) (CSU, UC-with unit limitation)

**PHYS 0215R. Problem Solving for Physics 215***Unit: 1*

Formerly known as PHYS 4Z

Corequisite: Concurrent enrollment in PHYS 215

Hours: 18 lecture

Optional problem solving course to accompany PHYS 215. Includes thermodynamics, mechanical waves, optics, and modern physics. (CSU, UC-with unit limitation)

## Program Student Learning Outcomes (PSLOs)

- Correctly apply the appropriate mathematical tools and physical concepts to solve problems and model physical systems at a level commensurate with the level of mathematics required.
- Apply basic physical principles conceptually to explain simple physical systems and everyday phenomena at a level commensurate with the level of mathematics required.
- Utilize technology as an experimental tool at a level commensurate with the curriculum.
- Evaluate, analyze, and interpret scientific data and utilize verbal and written communication skills to share their results of physical measurements at a level commensurate with the curriculum.