

# PHYSICS, BS

## Introduction

Please click here (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/physics/>) to see Physics department information.

The department of Physics at the University of Colorado Denver enriches understanding of how the world works by incorporating physics in every aspect of life. Good intuition about how things work has been, since the time of Galileo, a hallmark of physicists.

CU Denver's faculty is committed to providing substantive applied research experiences for our undergraduate students by incorporating aspects of every day life into their classrooms and research. A major in physics is one of the few academic degree programs that prepares its students for an amazing array of careers including computer analyst, engineer, technical writer, industrial marketer, doctor, and lawyer.

Our faculty is committed to provide students with opportunities for laboratory experience in a research environment. Students work elbow-to-elbow with their professor mentors on such projects as:

- Applying chaos and complex systems theory to problems ranging from the onset of turbulence in fluid flows to the erratic motions of loads hanging from cranes aboard ships at sea
- Study of quasar jets and other associated dynamical properties, supernovae and nucleosynthesis
- Superconducting Quantum Interference Devices (SQUIDS) specifically the fabrication of microelectronic SQUIDS
- Applying non-linear dynamics and stochastic modeling to biological systems to understand how variations in genotype can lead to unique behavior
- Developing detection techniques in the search for the Dark Matter component of our Universe
- Applying physics to archaeology and historic preservation
- Developing ways to help students learn physics better

Those students intending to major in physics should have a high school background that includes trigonometry, advanced algebra, chemistry and physics, as well as a good preparation in the arts and humanities. Students have an option during their freshman year to overcome some deficiencies in these areas. Students preparing for employment in an interdisciplinary area (such as environmental, geophysical or energy study) can choose to add an appropriate minor or arrange a specific major program on an individual basis. Students interested in teaching physics in high school are encouraged to consider the CLAS educational studies minor in addition to their physics major.

Students are strongly encouraged to consult with the Physics advisor, meet physics faculty engaged in research, attend departmental seminars, and explore ways that Physics relates to research undertaken by faculty in other disciplines.

## For more information, contact:

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These degree requirements are subject to periodic revision by the academic department, and the College of Liberal Arts and Sciences

reserves the right to make exceptions and substitutions as judged necessary in individual cases. Therefore, the College strongly urges students to consult regularly with their major advisor and CLAS advisor to confirm the best plans of study before finalizing them.

## Program Delivery

- This is an on-campus program.

## Declaring This Major

- Click here (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/#policiestext>) to go to information about declaring a major.
- Students pursuing the 4+1 track must apply and be accepted for participation in the BS/MIS program prior to completion of the BS degree in consultation with both the undergraduate and graduate advisors. Students must complete a 4+1 intent form ([http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/physics/physics-bs/BMA\\_form\\_1\\_1\\_.pdf](http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/physics/physics-bs/BMA_form_1_1_.pdf)) to formally declare this program, as they work very closely with undergraduate and graduate advisors to ensure they are on track and completing requirements as necessary. Students must apply and be accepted to the Integrated Sciences, MIS during the last semester of their undergraduate career. A maximum of 12 credit hours of graduate level courses that are applied to the undergraduate degree will apply to the graduate degree.
- If you are planning on teaching after graduation, the College of Liberal Arts and Sciences (CLAS) has partnered with the School of Education & Human Development (SEHD) to enable CU Denver undergraduates to get a jumpstart on their teaching careers. When you join the minor in Teacher Education, you gain access to a 4+1 program that helps you earn your CLAS degree, a Master's in Teaching, and would qualify for a Colorado Teaching License in five years. Click here (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/interdisciplinary-programs/liberal-arts-sciences-babs-41-teaching-ma/>) for more information.

## General Requirements

To earn a degree, students must satisfy all requirements in each of the three areas below, in addition to their individual major requirements.

- CU Denver General Graduation Requirements (<http://catalog.ucdenver.edu/cu-denver/undergraduate/graduation/>)
- CU Denver Core Curriculum (<http://catalog.ucdenver.edu/cu-denver/undergraduate/graduation-undergraduate-core-requirements/>)
- College of Liberal Arts & Sciences Graduation Requirements (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/#graduationrequirementstext>)
- Click here (<http://catalog.ucdenver.edu/cu-denver/undergraduate/academic-policies-procedures/>) for information about Academic Policies

## Program Requirements

- Students must complete a minimum of 61 credits, including a minimum of 39 PHYS credit hours and a minimum of 16 credit hours in ancillary coursework.
- Students must complete a minimum of 16 PHYS upper-division (3000-level and above) credit hours in the major.
- Students must earn a minimum grade of C- (1.7) in all courses that apply to the major and must achieve a minimum cumulative major GPA of 2.0. Courses taken using P+/P/F or S/U grading cannot apply to major requirements.
- Students must complete a minimum of 12 PHYS credit hours with CU Denver faculty.

## Program Restrictions, Allowances and Recommendations

- Students must declare their intention to major in Physics by the time they have completed 60 semester hours.
- Students pursuing the 4+1 track must apply and be accepted for participation in the BS/MIS program prior to completion of the BS degree in consultation with both the undergraduate and graduate advisors. Students must complete a 4+1 intent form ([http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/physics/physics-bs/BMA\\_form\\_1\\_1\\_.pdf](http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/physics/physics-bs/BMA_form_1_1_.pdf)) to formally declare this program, as they work very closely with undergraduate and graduate advisors to ensure they are on track and completing requirements as necessary.
  - A maximum of 12 credit hours of graduate level courses that are applied to the undergraduate degree will apply to the graduate degree. Students must also earn a B- or higher in graduate level coursework, for it to apply to the Integrated Science, MIS.
- The introductory labs, PHYS 2351 Applied Physics Lab I and PHYS 2361 Applied Physics Lab II, are required for all physics majors. If the department is unable to offer one or both of these labs then PHYS 2321 Intro Experimental Phys Lab I may be substituted for PHYS 2351 Applied Physics Lab I and PHYS 2341 Intro Experimental Phys Lab II may be substituted for PHYS 2361 Applied Physics Lab II, upon prior advisor approval.
- Students earning a Physics major cannot earn a Physics minor.
- All physics majors must complete a capstone thesis or capstone project. Writing and defending a thesis is required for all students wishing to graduate with departmental honors.
- The physics faculty also encourage all physics majors to enroll in PHYS 1450, 3450, and 4450 Professional Development I, II, and III seminar courses.

Code	Title	Hours
<b>Complete all of the following required courses:</b>		<b>30</b>
PHYS 2311	General Physics I: Calculus-Based	
PHYS 2351	Applied Physics Lab I	
PHYS 2331	General Physics II: Calculus-Based	
PHYS 2361	Applied Physics Lab II	

PHYS 2711	Vibrations and Waves
PHYS 2811	Modern Physics I
PHYS 3120	Methods of Mathematical Physics
PHYS 3211	Analytical Mechanics
PHYS 3411	Thermal Physics
PHYS 3711	Advanced Experimental Physics Laboratory (must be taken twice for a total of four credit hours)

### Complete courses for one of the following tracks: 12-14

*Students following the Pure and Applied Physics track complete a minimum of 14 credit hours from the following courses:*

PHYS 4211	Quantum Mechanics
PHYS 4212	Quantum Mechanics Seminar
PHYS 4311	Electricity & Magnetism
PHYS 4312	Electricity & Magnetism Seminar

Complete a minimum of six 3000-level or above PHYS credit hours (maximum of up to three semester hours of directed research or independent study can count towards this requirement).<sup>2</sup>

*Students following the Physics, BS 4+1, Masters of Integrated Science track complete 12 credit hours from the following courses. These courses will also apply to the MIS:*

MINS 5200	Research Methods in Interdisciplinary Science
PHYS 5211	Quantum Mechanics
PHYS 5311	Electricity & Magnetism
One graduate level STEM (MATH, PHYS, ELEC, BIOL, etc.) course chosen to meet the student's MIS Program Goals, in consultation with the MIS Program Director.	

### Complete one of the following options: 3

#### Option 1

PHYS 3751	Physics Capstone Proposal
PHYS 4751	Physics Capstone Thesis (must take twice and complete two credit hours) <sup>1</sup>

#### Option 2

PHYS 3751	Physics Capstone Proposal
PHYS 4711	Physics Capstone Project

### Complete all of the following required ancillary courses: 16-18

MATH 1401	Calculus I
MATH 2411	Calculus II
MATH 2421	Calculus III
MATH 3191 & MATH 3200	Applied Linear Algebra and Elementary Differential Equations
MATH 3191	Linear Algebra and Differential Equations

### Total Hours 61-65

<sup>1</sup> PHYS 4751 Physics Capstone Thesis must be taken twice by physics majors who must also complete a minimum of 135 hours of research through completion of three credits of PHYS 4880 Directed Research or a research internship or other documented evidence of research efforts.

<sup>2</sup> Electives with a prefix other than PHYS may be considered in consultation with your departmental academic advisor and with approval of the physics department chair.

To learn more about the Student Learning Outcomes for this program, please visit our website (<https://clas.ucdenver.edu/physics/academics/program-learning-goals/>).

To review the Degree Map for this program, please visit our website.  
(<https://www.ucdenver.edu/student/advising/undergraduate/degree-maps/clas/>)