INTRODUCTION
The physics department has established a Graduate Certificate Program in Applied Physics. By choosing this program, your Ph.D. degree will still be in physics, but the five core courses you take in your first few years of graduate school can be tailored towards a quicker entry into an emerging interdisciplinary area of research. Areas of specialization include Imaging Science, Nano and Materials Science, Biophysics, Geophysics, Plasma Science, Laser Science, Photonics as well as other potential future areas of interest. This program allows students to take core courses from departments outside of physics when appropriate, to better prepare them for cutting-edge research at the interface between disciplines.

As is the case for our regular Ph.D. degree program, ten graduate courses are required for a Ph.D. Example courses sequences for the Applied Physics certificate program are given below. The Comprehensive Examination sequence for this certificate program is similar to that of our regular physics Ph.D. degree. Comps I consists of the topics covered in the 5 core courses in each area of specialization. The Comps II examination is based on a paper and presentation together with an oral examination, as in our regular physics degree program. The formal thesis proposal (Comps III) is also the same as our regular physics degree program, consisting of a formal thesis proposal presentation to a faculty committee.

Please talk to your Advisor and/or the Associate Chair for Graduate Studies in Physics (currently Professor Tobin Munsat) if you are interested in this program. They will help you to plan your program of studies. You will need to have a Comps I curriculum form (downloadable below) approved by both your advisor and the Associate Chair for Graduate Studies.

Sample curricula for various Applied Physics subdisciplines are listed below.
Sample Ph.D. Curriculum in Imaging Science

Comps 1 courses; five from this list:
- PHYS 5160  Fundamentals of Optics and Lasers
- PHYS 5250, 5260  Quantum Mechanics 1 & 2
- PHYS 7310, 7320  Electromagnetic Theory 1 & 2
- ECEN 5126  Computational Optical Imaging

Other courses (to bring total to 30 credits) to be selected from this list:
- PHYS 5210  Theoretical Mechanics
- PHYS 5606  Optics Laboratory
- PHYS 7230  Statistical Mechanics
- PHYS 7440  Theory of the Solid State 1
- PHYS 7650  Nonlinear and Nano Optics
- PHYS 7660  Ultrafast Optics
- PHYS 7810  Special Topics in Physics: EUV Science and Technology
- APPM 5600, 5610  Numerical Analysis 1, 2
- CSCI 5254  Convex Optimization and its Applications
- CSCI 5922  Neural Networks and Deep Learning
- ECEN 5156  Physical Optics
- ECEN 5532  Digital Signal Processing Laboratory
- ECEN 5616  Optoelectronic System Design
- ECEN 5632  Introduction to Digital Filters
- ECEN 5672  Digital Image Processing
- ECEN 5696  Fourier Optics
- ECEN 6006  Numerical Methods in Photonics

Other graduate courses at CU, including independent study

Sample Ph.D. Curriculum in Biophysics

Comps 1 courses; five from this list:
- PHYS 5250  Quantum Mechanics 1
- PHYS 5560  Introduction to Biophysics
- PHYS 7230  Statistical Mechanics
- PHYS 7310  Electromagnetic Theory 1
- CHEM 5771  Advanced General Biochemistry 1

Other courses (to bring total to 30 credits) to be selected from this list:
- PHYS 5160  Fundamentals of Optics and Lasers
- PHYS 5260  Quantum Mechanics 2
- PHYS 7240  Advanced Statistical Mechanics
- PHYS 7320  Electromagnetic Theory 2
- CHEM 5776  Scientific Ethics (1 credit seminar course)
- CHEM 5781  Advanced General Biochemistry 2 (5 credits)
- CHEM 5801  Advanced Signal Transduction
- MCDB 5520  Bioinformatics and Genomics
- MCDB 5550  Cellular and molecular motion, a biophysical approach (proposed)
Sample Ph.D. Curriculum in **Optics and Laser Science**

**Comps 1 courses; five from this list:**
- PHYS 5160 Fundamentals of Optics and Lasers
- PHYS 5250, 5260 Quantum Mechanics 1 & 2
- PHYS 7310, 7320 Electromagnetic Theory 1 & 2
- ECEN 5606 Advanced Optics Laboratory

**Other courses (to bring total to 30 credits) to be selected from this list:**
- PHYS 7550 Atomic and Molecular Spectra
- PHYS 7560 Quantum Optics
- ECEN 5156 Physical Optics
- ECEN 5616 Optoelectronic System Design
- ECEN 5645 Introduction to Optical Electronics
- ECEN 5166 Guided Wave Optics
- ECEN 5626 Active Optical Devices
- ECEN 5696 Fourier Optics
- ECEN 6006 Numerical Methods in Photonics

Other graduate courses at CU including independent study

Sample Ph.D. Curriculum in **Geophysics**

(NOTE: students in Geophysics can also avail of Geophysics Degree Program)

**Comps 1 courses; five from this list:**
- PHYS 5210 Theoretical Mechanics
- PHYS 5250 Quantum Mechanics 1
- PHYS 6610, 20, 30 Earth and Planetary Physics 1, 2 & 3
- PHYS 7310 Electromagnetic Theory 1

**Other courses (to bring total to 30 credits) to be selected from this list:**
- PHYS 5150 Introductory Plasma Physics
- PHYS 5260 Quantum Mechanics 2
- PHYS 7230 Statistical Mechanics
- PHYS 7320 Electromagnetic Theory 2
- PHYS 7440 Theory of the Solid State 1
- ASTR 5400 Introduction to Fluid Dynamics
- ASEN 5331 Computational Fluid Mechanics
- MCEN 5023 Solid Mechanics 1

Other graduate courses at CU including independent study
Sample Ph.D. Curriculum in **Nano and Materials Science**

**Comps 1 courses; five from this list:**

- PHYS 5250, 5260  Quantum Mechanics 1 & 2
- PHYS 7230  Statistical Mechanics
- PHYS 7310  Electromagnetic Theory 1
- PHYS 7440  Theory of the Solid State 1

**Other courses (to bring total to 30 credits) to be selected from this list:**

- PHYS 5520  Introduction to Magnetic Materials and Devices
- PHYS 7320  Electromagnetic Theory 2
- PHYS 7430  Soft Condensed Matter
- PHYS 7450  Theory of the Solid State 2
- ECEN 5005  Special Topics: Organic Electronics
- ECEN 5015  Special Topics: Nanophotonics
- ECEN 5355  Principles of Electronic Devices
- ECEN 5555  Principles of Energy Systems & Devices
- ECEN 6005  Special Topics: Photovoltaic Devices

Other graduate courses at CU including independent study.

Sample Ph.D. Curriculum in **Plasma Science**

**Comps 1 courses; five from this list:**

- PHYS 5150  Introductory Plasma Physics
- PHYS 7310, 7320  Electromagnetic Theory 1 & 2
- PHYS 5210  Theoretical Mechanics
- PHYS 5250  Quantum Mechanics 1
- PHYS 7230  Statistical Mechanics

**Other courses (to bring total to 30 credits) to be selected from this list:**

- PHYS 5030  Intermediate Mathematical Physics 2
- PHYS 5220  Nonlinear Dynamics
- PHYS 5260  Quantum Mechanics 2
- PHYS 5430  Advanced Laboratory
- PHYS 7160  Intermediate Plasma Physics
- ASEN 5331  Computational Fluid Mechanics
- ASTR 5400  Introduction to Fluid Dynamics

Other graduate courses at CU including independent study.

Sample Ph.D. Curriculum in **Engineering (for ECEE students)**

**Comps 1 courses; five from this list:**

- 1 semester in Quantum Mechanics
- 1 semester in Electromagnetic Theory
- PHYS 5160  Fundamentals of Optics and Lasers
- ECEN 5156  Physical Optics
ECEN 5606  Advanced Optics Laboratory
Other courses (to bring total to 30 credits) to be selected from this list:
PHYS 7550  Atomic and Molecular Spectra
PHYS 7560  Quantum Optics
ECEN 5696  Fourier Optics
ECEN 6006  Numerical Methods in Photonics
ECEN 5166  Guided Wave Optics
Other graduate courses at CU including independent study

Ph.D. Curriculum in Chemical Physics, Geophysics, Optical Science and Engineering, and Molecular Biophysics

There are existing programs in Chemical Physics, Geophysics, Optical Science and Engineering, and Molecular Biophysics that students can also apply to for admission.

Other areas of interest to faculty and students

Additional tracks may be added according to faculty and student interest. Please contact the Associate Chair for Graduate Studies if you are interested in discussing a new area of specialization.

Terminal Master's Curriculum For Certificate In Applied Physics

The master’s degree requirements for this program are the same as for the regular Ph.D. program, except the core courses are those listed in each area of specialization.

Engineering Students

Students from the College of Engineering who would like to supplement their Engineering Degree with a Certificate in Applied Physics may do so by taking courses at the graduate level that are equivalent to the proposed curricula. These would include a course on Quantum Mechanics or Applied Quantum Mechanics, a course on Electricity and Magnetism/Waves, as well as a laboratory course.