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 Nano and Materials Physics, Biophysics, Geophysics, Plasma Science, Laser Science, Photonics, as well as other potential future areas of interest. This program also 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 different 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. 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 the Chair for the Certificate in Applied Physics (currently Professor Charles Rogers) if you are interested in this program. The Chair will help you to plan your program of studies.

SAMPLE CURRICULA

Sample Ph.D. Curriculum in Biophysics

Five Core Courses
- Physics 5250 Quantum I
- Physics 7310 E&M I
- Physics 7230 Statistical Mechanics I
- Chem 5561 Methods in Molecular Biophysics
- Chem 6711 Advanced General Biochemistry I

Chem 5776 Scientific Ethics (1 credit seminar course)

Other courses up to 30 credit total to be selected from the following -
- Physics 5260 Quantum II
- Physics 7320 E&M II
- Physics 7240 Advanced Statistical Mechanics II
- Physics 7810 Lasers
- MCDB 5810 Biology and Biophysics of the Membrane
- Chem 5781 Advanced General Biochemistry II (5 credits)
- Chem 5661 Advances in Molecular Biophysics (3 credits)
- MCDB 5520 Bioinformatics and Genomics (3 credits)
- Chem 5801 Advanced Signal Transduction (3 credits)
- CHEM 5711 (3). General Biochemistry I
Sample Ph.D. Curriculum in Optics and Laser Science

**Five Core Courses**

- Quantum Mechanics 1 & 2 (PHYS 5250, 5260)
- Electromagnetic Theory 2 (PHYS 7320)
- Laser Physics (PHYS 7810)
- Advanced Optics and AMO Laboratory (ECEN 5606)

**Other courses up to 30 credit total to be selected from the following -**

- Atomic and Molecular Spectra (PHYS 7550)
- Nonlinear Optics (PHYS 7650)
- Ultrafast Spectroscopy (PHYS 7650)
- Crystal and Nonlinear Optics (ECEN 6006)
- Physical Optics (ECEN 5156)
- Quantum Optics (PHYS 7560)
- Fourier Optics (ECEN 5696)
- Opt Properties of Materials (ECEN 5385)
- Guided Wave Optics (ECEN 6166)
- 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)*

**Five Core Courses**

- Quantum Mechanics I (PHYS 5250)
- Electromagnetic Theory I (PHYS 7310)
- Theoretical Mechanics (PHYS 5210)
- Earth and Planetary Physics 2 & 3 (Phys 6620, 6630)

**Other courses up to 30 credit total to be selected from the following -**

- Quantum Mechanics II (Phys 5260)
- Electromagnetic Theory II (Phys 7320)
- Earth and Planetary Physics 1 (Phys 66210)
- Statistical mechanics (Phys 7230)
- Introductory Plasma Physics (Phys 5150)
- Nonlinear dynamics (Phys 5220)
- Theory of the solid state (Phys 7440)
- Introduction to Fluid Dynamics (APS5400)
- Computational Fluid Mechanics (ASEN5327)
- Solid Mechanics (MCEN 5023)
- Other graduate courses at CU including independent study

Sample Ph.D. Curriculum in Nano and Materials Science

**Five Core Courses**

- Introduction to Research in Modern Physics (PHYS 5430)
- Quantum Mechanics 1 & 2 (PHYS 5250, 5260)
- Electromagnetic Theory 1 & 2 (PHYS 7310, 7320)

**Other courses up to 30 credit total to be selected from the following -**

- Statistical Mechanics (PHYS 7230)
- Theory of the Solid State (PHYS 7440)
- Analytic Techniques and Material Analysis
- Introduction to Magnetic Materials and Devices
- Soft Condensed Matter/Complex Fluids
- Other graduate courses at CU including independent study
Sample Ph.D. Curriculum in Plasma Science

**Five Core Courses**

Introduction to Research in Modern Physics (PHYS 5430)
Quantum Mechanics 1 & 2 (PHYS 5250, 5260)
Electromagnetic Theory 1 & 2 (PHYS 7310, 7320)

**Other courses up to 30 credit total to be selected from the following -**

- Theoretical Mechanics (PHYS 5210)
- Statistical Mechanics (PHYS 7230)
- Introductory Plasma Physics (PHYS 5150)
- Intermediate Plasma Physics (PHYS 7160)
- Nonlinear dynamics (PHYS 5220)
- Other graduate courses at CU including independent study

Sample Ph.D. Curriculum in Engineering (for ECE students)

**Five Core Courses**

1 semester in Quantum Mechanics
1 semester in Electromagnetic Theory
Laser Physics (PHYS 7810)
Physical Optics (ECEN 5156)
Advanced Optics and AMO Laboratory (ECEN 5606)

**Other courses up to 30 credit total to be selected from the following -**

- Atomic and Molecular Spectra (PHYS 7550)
- Fourier Optics (ECEN 5696)
- Crystal and Nonlinear Optics (ECEN 6006)
- Quantum Optics
- Opt Properties of Materials (ECEN 5385)
- Guided Wave Optics (ECEN 6166)
- Microoptics (ECEN 6006)
- 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 discussion a new area of specialization.

TERMINAL MASTER’S CURRICULUM FOR CERTIFICATE IN APPLIED PHYSICS

The masters 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.