

BA/MS Concurrent Degree Program in Physics (Bachelor of Arts in Physics and Master of Science in Physics)

Statement of Purpose

The BA/MS program in Physics aims to provide new opportunities for undergraduate physics majors. The program is specifically addressed to the students in the Plan 1 Major Program of the Department of Physics. The Plan 1 physics major gives students a thorough grounding in theoretical physics so that they are well prepared either to proceed with graduate work or with professional employment. For students interested in graduate studies, the BA/MS program in Physics allows for participation in graduate course work and research in a broad range of areas. For students interested in immediate professional employment, the BA/MS program would serve as a terminal degree program that qualifies students for a higher level of employment.

1. Admission to the program

- **Eligibility:** Students are eligible to apply for the program at the end of the first semester of their junior year (or upon completion of the typical first semester junior physics courses as described in the physics curriculum) and may apply at any time thereafter prior to completion of their undergraduate studies. Student must meet with advisor of program (Chair of Arts and Sciences Physics Advising Committee) prior to submitting application materials.
- **Application:**
 - Completed BA/MA Application for Admission (on Graduate School website)
 - Letter of support from a faculty sponsor/advisor to do research towards their master's level research. The letter must describe the Master's thesis project, the time scale for completion, and the minimum goals achieved to be considered acceptable for the degree completion.
 - Minimum cumulative 3.30 GPA at the time of application, and a minimum major GPA of 3.30 in PHYS courses.
- All application materials must be submitted to the Undergraduate Coordinator in the Department of Physics Main Office (DUAN E1B32). The letter of support should be sent from the faculty directly to the Undergraduate Coordinator.
- Upon acceptance of the applicant into the program at the departmental level, the application will be forwarded to the Deans of the College of Arts and Sciences and the Graduate School for endorsement.

2. Continuation in the program

In order to continue in the program after admission, a minimum cumulative 3.30 GPA is required at the end of the senior year, with 120 hours completed. After the senior year, the student must maintain a cumulative GPA of 3.00 (B) for the duration of the program. All graduate courses applied to the concurrent degree program must be completed with a "B-" or better.

3. Curriculum

The following charts show a typical curriculum for years 1 through 4 and the first year of graduate studies.

Physics 8-semester overview of physics courses (suggested schedule only)

FRESHMAN YEAR

Fall Semester

PHYS 1110 or 1115 General Physics 1 (4)

Spring Semester

PHYS 1120 or 1125 General Physics 2 (4)
PHYS 1140 Experimental Physics (1)

SOPHOMORE YEAR

Fall Semester

PHYS 2170 Foundations of Modern Phys (3)
PHYS 2150 Experimental Physics (1)

Spring Semester

PHYS 2210 Classical Mech & Math Methods 1 (3)

JUNIOR YEAR

Fall Semester

PHYS 3210 Classical Mech & Math Methods 2 (3)
PHYS 3310 Principles of Elec & Mag 1 (3)
PHYS 3330 Junior Laboratory (2)

Spring Semester

PHYS 3220 Quantum Mechanics (3)
PHYS 3320 Principles of Elec & Mag 2 (3)
Physics Elective (3)

SENIOR YEAR

Fall Semester

PHYS 4230 Thermo/Stat Mech (3)
PHYS 4410 Atomic & Nuclear Physics (3)
Physics Elective (3)

Spring Semester

Physics Elective (3)

This chart emphasize the required physics courses. In addition, students are expected to take courses to satisfy the College of Arts and Sciences undergraduate requirements, and additional applied mathematics and chemistry courses that are part of the physics major. At the end of the fourth year, students will have completed 45 credit hours of physics courses, consistent with the present Plan 1 major requirements of 45 credits. We note that students in the BA/MS program may still participate in the physics honors sequence and qualify for honors designation on their BA degree.

The fifth year typical curriculum includes 9 credit hours of required physics classes, 9 credit hours of physics electives, and 6 credit hours of research, for a total of 24 credit hours at the graduate level:

Fifth Year standard required graduate courses (9 credit hours)

PHYS 5260 Introduction to Quantum Mechanics 2 (3)
PHYS 7230 Statistical Mechanics (3)
PHYS 7310 Electromagnetic Theory 1 (3)

Other graduate courses may be taken in place of these required courses by petition to the Chair of the Arts and Sciences Advising Committee in the Department of Physics.

Fifth Year typical graduate electives (9 credit hours)

PHYS 5210 Theoretical Mechanics (3) **by petition
PHYS 5250 Intro to Quantum Mechanics 1 (3) **by petition
PHYS 5030 Intermediate Math Physics 1 (3)
PHYS 5040 Intermediate Math Physics 2 (3)
PHYS 5150 Introductory Plasma Physics (3)
PHYS 5160 Fundamentals of Optics and Lasers (3)
PHYS 5606 Optics Laboratory (3)
PHYS 5770 Gravitational Theory (3)
PHYS 6610 Earth and Planetary Physics 1 (3)
PHYS 7160 Intermediate Plasma Physics (3)
PHYS 7240 Advanced Statistical Mechanics (3)
PHYS 7320 Electromagnetic Theory 2 (3)
PHYS 7430 Soft Condensed Matter Physics (3)
PHYS 7440 Theory of the Solid State (3)
PHYS 7450 Theory of Solid State 2 (3)
PHYS 7550 Atomic and Molecular Spectra (3)
PHYS 7560 Quantum Optics (3)
PHYS 7650 Nonlinear and Nano-Optics (3)
PHYS 7660 Ultrafast Optics (3)
PHYS 7730 Theory of Elementary Particles (3)
PHYS 7810 Special Topics in Physics (3)

Graduate electives other than those listed, including those from other disciplines may also be taken with prior approval of the Chair of the Arts and Sciences Advising Committee in the Department of Physics.

Fifth Year Master's research experience (6 credit hours of graduate research)

There are two options available, which include either writing and defending a master's thesis or passing the Comprehensive Examination II.

1. PHYS 6950 Master's Thesis (6 credit hours total, no more than 3 credit hours per semester)
**Must complete master's thesis and defense, per Graduate School guidelines, see website for guidelines: <http://www.colorado.edu/physics/academics/graduate-students/graduate-program-requirements-phd/masters-degree#withthesis>
2. PHYS 5840 Graduate Independent Study (6 credit hours total, no more than 3 credit hours per semester)
**Must complete Comprehensive Examination II:
 - a. **Paper:** Preparation of a formal paper that summarizes the student's research turned in at least two weeks prior to the exam. The paper should be a formal, publication-quality document of 2500-3000 words. It should contain an abstract, figures and/or tables properly referenced, and citations. The paper's writing quality, organization, typesetting, and figures should be up to professional standards.
 - b. **Exam:** The student then delivers a 20 minute oral presentation about the content of the research paper, followed by 60 minutes of questions. At least 40 minutes of questions will be on physics topics unrelated to the talk or paper.
 - c. **Proposal and Committee Selection:** The student must submit a title and abstract to the Comprehensive Exam Committee (CEC) at least 2 months before the anticipated exam date. The CEC will choose appropriate committee members for the exam.
 - i. The student's research advisor may not be a member of the exam committee
 - ii. One member of the CEC must be on the exam committee
 - iii. The Chair of the Arts and Sciences Advising Committee or the Associate Chair of Graduate Studies must be on the exam committee

4. Escape plan

Participating students can drop out of the BA/MS program at the end of the fourth year and graduate with a Bachelor of Arts in Physics. The curriculum chart shows that at this point the student will have completed 45 credit hours in required physics courses. This number of hours is equal to the number presently required of engineering physics majors earning the BA degree.