

University Curriculum Committee Proposal for Change in Program

Department of Physics and Physical Oceanography

**Justification for addition of a
Degree Option to the B.S. Degree in Physics
and a Minor in Physical Oceanography.**

Purpose: Proposal for Physical Oceanography Option to the BS Degree in Physics and a Minor in Physical Oceanography

Presently the department offers degree concentrations in general physics at the BA and BS levels, a program towards Teacher Licensure in Physics, and a 3 + 2 Physics/ECE degree program with North Carolina State University (NCSU). The **B.A. degree track** is ideally suited to students planning to teach at the secondary school level, or others who may not plan to become professional physicists but who desire an interdisciplinary program with a physics emphasis. The **B.S. degree track** is principally aimed at training undergraduates for further, graduate-level, studies in physics. The **3 + 2 engineering program** gives students the opportunity to earn a **B.S.** in Physics from UNCW and a **B.S.** in Electrical Engineering from North Carolina State University (NCSU). Here we propose to *expand the options* within the **General B.S.** program into the arena of **Physical Oceanography**.

The proposed revision to the **Physics and Physical Oceanography BS** major into *Options in General Physics (Option 1) and Physical Oceanography (Option 2)* is designed to help bridge the gap between the student interested teaching, or going to graduate school in general physics and those interested in pursuing a degree in a more applied area of physics, namely physical oceanography. The general undergraduate physics program includes courses in electricity and magnetism, experimental physics, thermodynamics, and quantum mechanics. The option in physical oceanography will combine a sound grasp of the fundamental concepts of the general physics program with a working knowledge of the oceanographic domain. This will enable students graduating with a major in physics to be poised to significantly improve their career potential in the environmental regime.

The additional courses being added to the Physics curriculum to support the proposed option in Physical Oceanography, will also allow an expansion of the offerings by the department to include a **Minor in Physical Oceanography**. This will essentially allow expansion of the offerings by the physics department to all of the traditional science departments and cooperative interdisciplinary activities and strengthen the undergraduate marine science program.

Rationale: One of the areas of importance to the “coastal university of North Carolina”, the University of North Carolina Wilmington, is a commitment to the study of marine and coastal issues. The strength of marine science at UNCW results from a common emphasis on marine science within the traditional science departments and cooperative interdisciplinary activities. The Department already supports the University’s emphasis on marine science through its curricular offerings in physical oceanography. Here we are building upon this foundation by identifying a course of study in physical oceanography that satisfies all the basic requirements of a general undergraduate physics program, which includes electricity and magnetism, experimental physics, thermodynamics, and quantum mechanics, while including a working knowledge of the oceanographic domain.

Expansion of the physics degree to include applied options would greatly enable students graduating with a B.S. in physics to be poised to significantly improve their career potential. Because of the strong focus on marine science at the undergraduate and graduate level at UNCW, the Physics Department was renamed to become the Department of Physics and Physical Oceanography in 1998. Since that point the Department has been slowly adding courses in physical oceanography to the physics curriculum to fulfill the dual roles of providing electives for the undergraduate physics majors, as well as in support of the other undergraduate disciplines in marine science and the MS in Marine Science.

With the recent addition of faculty qualified to teach courses in both the traditional physics curriculum and in physical oceanography, the Department now has the ability to add the courses needed to support an Option in Physical Oceanography within the Physics curriculum. By offering an Option in Physical Oceanography, the Physics Department is broadening the potential career paths of our students into the environmental regime. We feel that the option will attract students interested in environmental problems to pursue an undergraduate degree in physics. Because the students will continue to be well versed in the traditional areas of physics as well as physical oceanography, students graduating in this course of study are well prepared to pursue careers in physics, physical oceanography, or a wide variety of environmental programs. Technical positions in private or government oceanographic research laboratories are available for physical oceanographers at the B.S. level. Students who continue on to graduate studies should expect to find high demand for physical oceanographers with advanced degrees. Students entering graduate school in physical oceanography from this program will have a significant head start compared to those entering from most other undergraduate institutions. At the local level, an undergraduate degree option in physical oceanography will help to expand the resource base and the potential student pool for the existing M.S. in Marine Science within the College of Arts and Sciences in conjunction with the Center for Marine Science, which currently includes a core area in physical oceanography, taught by faculty within the Department of Physics and Physical Oceanography.

Courses to be added to the Undergraduate B. S. in Physics Curriculum

PHY 315. Computational Physics and Complexity (3)

PHY 350. Fluid Mechanics (3)

PHY 477. (577) Observational Methods and Data Analysis in Physical Oceanography (3)

PHY 478. (578) Geophysical Fluid Dynamics (3)

PHY 479. (579) Ocean Circulation Systems (3)

PHY 480. (580) Coastal and Estuarine Systems (3)

PHY 481. Undergraduate Cruise Experience (1)

Proposed Revision to B.S. in Physics Degree
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Requirements for a Major in Physics for the B.A. Degree: 46 hours. PHY 201-202, 260, 300, 321, 335, plus 6 hours of physics course electives at the 300-400 level; CHM 101-102; MAT 161-162 and 261.

Requirements for a Major in Physics for the B.S. degree: PHY 201-202, 311, 321, 335, 411, 444, 455, and 495; CHM 101-102; MAT 161-162, 261, and 361; one of the following options to fulfill the degree requirements.

Option 1. General Physics. 66 hours. Core requirements plus PHY 300, 322, 400, and 412; MAT335.

Option 2. Physical Oceanography. 72 hours. Core Requirements plus PHY 315, 350, 475, 477, 481 and 1 course chosen from PHY478, 479, 480; and GLY150.

Students must attain a grade point average of "C" (2.00) or better computed over all the courses used to fulfill the requirements of the major and a grade of "C-" or better for each PHY course used to fulfill the requirements of the major.

Proposed Addition of Minor in Physical Oceanography

Requirements for a Minor in Physical Oceanography: (21 hours.) PHY 201-202, 475, 477, 481 and 1 additional course from PHY 315, 350, 478, 479, 480. GLY150.

A grade of "C" or better is required in each physics course counted toward the minor.

**Undergraduate Catalog Changes for
Department of Physics and Physical Oceanography**

PHYSICS AND PHYSICAL OCEANOGRAPHY

<http://uncw.edu/phy>

Dr. C. Moyer, chair. Dr. Alexanian, Dr. Bingham, Dr. Black, Dr. Davis, Dr. Gan, Dr. Morrison, Dr. McNamara, Dr. Olszewski.

The Department of Physics and Physical Oceanography offers programs leading to the B.S. and B.A. degrees that prepare students for careers in teaching and industry, or for advanced study in physics and related disciplines.

Computer Competency Requirement: To satisfy the computer competency requirement for the B.A. or B.S. degree in physics a student must successfully complete PHY 300, 315, or 400.

Oral Communication Competency Requirement: To satisfy the oral communication competency requirement for the B.A. or B.S. degree in physics a student must successfully complete PHY 495 or any other approved oral intensive course (see list on [page 117](#)).

Applied Learning Requirement: To satisfy the applied learning requirement for the B.A. or B.S. degree in physics a student must successfully complete one of the following: directed individual study in any scientific discipline; departmental honors in any science department; PHY 493, 495.

Requirements for a Major in Physics for the B.A. Degree: 46 hours. PHY 201-202, 260, 300, 321, 335, plus 6 hours of physics course electives at the 300-400 level; CHM 101-102; MAT 161-162 and 261.

Requirements for a Major in Physics for the B.S. degree: PHY 201-202, 311, 321, 335, 411, 444, 455, and 495; CHM 101-102; MAT 161-162, 261, and 361; These core courses must be supplemented with one of the following options to fulfill the degree requirements.

Option 1. General Physics. 66 hours. Core requirements plus PHY 300, 322, 400, and 412; MAT335.

Option 2. Physical Oceanography. 72 hours. Core requirements plus PHY 315, 350, 475, 477, 481 and 1 course chosen from PHY478, 479, 480; and GLY150.

Students must attain a grade point average of "C" (2.00) or better computed over all the courses used to fulfill the requirements of the major and a grade of "C-" or better for each PHY course used to fulfill the requirements of the major.

Requirements for Teacher Licensure in Physics: In addition to completing the requirements for a degree in physics (see above) and the other requirements of the Teacher Education Program, the following courses are also required for licensure: BIO 201; GLY 120. For information on the [Teacher Education Program](#) admissions criteria and the courses required for licensure in North Carolina, see the [Watson School of Education](#) section of this catalogue. Students planning to pursue licensure should apply to the Watson School of Education as soon as admissions requirements are met (typically in the sophomore year) and plan their programs in regular consultation with their advisors. Teacher licensure requirements are established at the

state level and may be changed by the state at any time.

Note: Students interested in the B.S. degree in physics are advised to take the PHY 201- 202 sequence in the freshman year.

Requirements for a Minor in Physics: 18 hours. PHY 201-202, 335 and 6 additional hours in physics, not to include PHY 101, 102, or 105; at least 3 of these additional hours must be at the 300-400 level.

A grade of "C" or better is required in each physics course counted toward the minor.

Requirements for a Minor in Physical Oceanography: (21 hours.) PHY 201-202, 475, 477, 481 and 1 additional course from PHY 315, 350, 478, 479, 480. GLY150.

A grade of "C" or better is required in each physics course counted toward the minor.

**Undergraduate Catalog Course Descriptions:
Additions to Undergraduate Curriculum in Physics and Physical Oceanography.**

PHY 315. Computational Physics and Complexity (3) Corequisites: PHY 321 or MAT 361. Use of numerical modeling techniques for solving problems in physics and complex systems. Topics that will serve as the means for applying learned numerical techniques include classical mechanics; bifurcation and dynamical systems; chaotic systems; thermodynamics; optimization; cellular automata; self-organization.

PHY 350. Fluid Mechanics (3) Prerequisites: PHY 321 and MAT 361. A comprehensive account of fluid dynamics that emphasizes fundamental physical principles. Fluid statics; fluid kinematics; integral and differential forms of the conservation laws for mass, momentum and energy; Bernoulli equation; laminar flows; potential flows; vorticity dynamics; dynamic similarity; boundary layers; turbulence.

PHY477. (577) Observational Methods and Data Analysis in Physical Oceanography (3) Pre-requisites: PHY 315, PHY 475. This course will supply the student with a working knowledge of the use and operation of various physical oceanographic instruments and data reduction and analysis techniques. Credit is not allowed for both PHY 477 and PHY 577.

PHY 478. (578) Geophysical Fluid Dynamics (3) Prerequisite: PHY 350, Corequisite: PHY475. The fundamental principles governing the flow of a density-stratified fluid on a rotating planet, with applications to the motions of the ocean and atmosphere. Equations of state, compressibility, Boussinesq approximation. Geostrophic balance, Rossby number. Poincare, Kelvin, Rossby waves, geostrophic adjustment. Credit is not allowed for both PHY 478 and PHY 578.

PHY479. (579) Ocean Circulation Systems (3) Prerequisite: PHY 475. Course focuses on results of World Ocean Circulation Experiment (WOCE), a multi-national, multi-decadal program designed to observe the global ocean. Explores large-scale circulation and properties of the ocean to lay the foundation for the challenge of understanding the future of the world oceans and their role in climate change. Credit is not allowed for both PHY 479 and PHY 579.

PHY 480. (580) Coastal and Estuarine Systems (3) Prerequisite: PHY 475. An introduction to the physical processes operating within coastal and estuarine systems. The focus of the course will be on the dynamical description of topics such as gravity waves, surf zone hydrodynamics, storm surge, tides, estuarine hydraulics, sediment transport and morphodynamics. Credit is not allowed for both PHY 480 and PHY 580.

PHY 481. Undergraduate Cruise Experience (1) Prerequisite: Permission of Instructor. Broad exposure to planning and execution of oceanographic research operations, including demonstration of techniques and equipment regularly used aboard ships and familiarization with acquisition and processing of oceanographic data via preparation for and participation in a demonstration cruise under the guidance of UNCW physics and physical oceanography faculty members.

<p style="text-align: center;">Additions to Graduate Curriculums: Marine Science & Physics and Physical Oceanography</p>

PHY 550. Fluid Mechanics (3)

PHY 577. (477) Observational Methods and Data Analysis in Physical Oceanography (3)

PHY 578. (478) Geophysical Fluid Dynamics (3)

PHY 579. (479) Ocean Circulation Systems (3)

PHY 580. (480) Coastal and Estuarine Systems (3)

**Graduate Catalog Course Descriptions:
Additions to Graduate Curriculums in Marine Science**

PHY 550. Fluid Mechanics (3) Prerequisite: Permission of Instructor. A comprehensive account of fluid dynamics that emphasizes fundamental physical principles. Fluid statics; fluid kinematics; integral and differential forms of the conservation laws for mass, momentum and energy; Bernoulli equation; laminar flows; potential flows; vorticity dynamics; dynamic similarity; boundary layers; turbulence.

PHY 577. (477) Observational Methods and Data Analysis in Physical Oceanography (3) Prerequisite: Permission of Instructor. This course will supply the student with a working knowledge of the use and operation of various physical oceanographic instruments and data reduction and analysis techniques. Credit is not allowed for both PHY 477 and PHY 577.

PHY 578. (478) Geophysical Fluid Dynamics (3) Prerequisite: PHY 550, Corequisite: PHY475 or 575. The fundamental principles governing the flow of a density-stratified fluid on a rotating planet, with applications to the motions of the ocean and atmosphere. Equations of state, compressibility, Boussinesq approximation. Geostrophic balance, Rossby number. Poincare, Kelvin, Rossby waves, geostrophic adjustment. Credit is not allowed for both PHY 478 and PHY 578.

PHY 579. (479) Ocean Circulation Systems (3) Prerequisite: PHY 475 or 575. Course focuses on results of World Ocean Circulation Experiment (WOCE), a multi-national, multi-decadal program designed to observe the global ocean. Explores large-scale circulation and properties of the ocean to lay the foundation for the challenge of understanding the future of the world oceans and their role in climate change. Credit is not allowed for both PHY 479 and PHY 579.

PHY 580. (480) Coastal and Estuarine Systems (3) Prerequisite: PHY 475 or 575. An introduction to the physical processes operating within coastal and estuarine systems. The focus of the course will be on the dynamical description of topics such as gravity waves, surf zone hydrodynamics, storm surge, tides, estuarine hydraulics, sediment transport and morphodynamics. Credit is not allowed for both PHY 480 and PHY 580.

**Graduate Catalog Course Descriptions:
Additional Courses for Graduate Curriculum in
Physics and Physical Oceanography**

PHY 550. Fluid Mechanics (3) Prerequisite: Permission of Instructor. A comprehensive account of fluid dynamics that emphasizes fundamental physical principles. Fluid statics; fluid kinematics; integral and differential forms of the conservation laws for mass, momentum and energy; Bernoulli equation; laminar flows; potential flows; vorticity dynamics; dynamic similarity; boundary layers; turbulence.

PHY 577. (477) Observational Methods and Data Analysis in Physical Oceanography (3 hours) Prerequisite: Permission of Instructor. This course will supply the student with a working knowledge of the use and operation of various physical oceanographic instruments and data reduction and analysis techniques. Credit is not allowed for both PHY 477 and PHY 577.

PHY 578. (478) Geophysical Fluid Dynamics (3) Prerequisite: PHY 550, Corequisite: PHY475 or 575. The fundamental principles governing the flow of a density-stratified fluid on a rotating planet, with applications to the motions of the ocean and atmosphere. Equations of state, compressibility, Boussinesq approximation. Geostrophic balance, Rossby number. Poincare, Kelvin, Rossby waves, geostrophic adjustment. Credit is not allowed for both PHY 478 and PHY 578.

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