

**Program Modification
Bachelor of Science / Artium Baccaureatus in Physics
Add concentration in Atmospheric Physics
College of Charleston**

Summary

The College of Charleston requests approval to offer a concentration in Atmospheric Physics to the Bachelor of Science and Artium Baccaureatus (B.S. and A.B.) in Physics to be implemented Fall 2016. The proposed program is to be offered through traditional instruction. The following chart outlines the stages of review for the proposal. The Advisory Committee on Academic Programs (ACAP) voted to recommend approval of the proposal. The program modification proposal is attached.

Stages of Consideration	Date	Comments
Program Proposal Received	1/15/16	Not Applicable
Conference Call	2/11/16	<p>After discussion about the rationale of the proposed new program in Meteorology, staff then asked about the designation of the proposed new concentration in Atmospheric Physics under the extant B.S./A.B. in Physics given that Atmospheric Physics is a branch of Meteorology as noted in the original Atmospheric Physics modification proposal submitted.</p> <p>College representatives stated that the reason for not adding the Atmospheric Physics concentration to the proposed Meteorology program proposal was because of the large number of Physics courses required for this concentration.</p>
ACAP Consideration	2/18/16	<p>Due to concurrent submissions and curricular similarities for the Atmospheric Physics modification proposal and the B.A. in Meteorology proposal, CHE staff invited ACAP to discuss the proposals jointly, though advising ACAP to consider the proposals for vote separately.</p> <p>The College of Charleston representative discussed the need for the proposed modification to the Physics program to include Atmospheric Physics.</p> <p>After summarizing the conference call, staff invited additional discussion about the proposal for Atmospheric Physics as a concentration of Physics and not Meteorology, which staff requested the College consider as a potential Bachelor of Science degree.</p> <p>Representatives from the College explained the rationale for the proposed designations.</p> <p>Staff requested supporting documentation, and stated a request for revisions to the proposal would be forthcoming.</p> <p>ACAP members voted to approve the program proposal.</p>

Stages of Consideration	Date	Comments
Comments and suggestions from CHE staff sent to the institution	2/26/16	<p>Staff requested the following revisions:</p> <ol style="list-style-type: none"> 1. An explanation for adding the concentration to the B.S. and A.B. in Physics, but not the B.A. 2. An explanation for not adding the concentration to the proposed Meteorology degree program since Atmospheric Physics is a branch of Meteorology. 3. An explanation of the statement in the proposal “other meteorology students will be guided to the newly proposed B.A. degree in meteorology,” and clarification whether meteorology students will be split between the proposed Physics concentration and the new Meteorology program. 4. A description of any potential curriculum changes to the current Physics program due to the addition of a new concentration and an explanation of any modifications to existing courses. 5. An explanation of new costs for the new concentration. 6. A chart listing the proposed courses for the modification to the B.S. and A.B. in Physics and the new B.A. in Meteorology.
Revised Program Proposal Received	3/10/16	<p>The revised proposal included the following responses:</p> <ol style="list-style-type: none"> 1. An explanation of the degrees and the decision to offer the concentration under Physics and not under the proposed Meteorology program, including: a) likely low demand for a B.A. in the concentration and b) the interdisciplinary nature of the concentration. 2. Program objectives that are more directly linked to Atmospheric Physics, including the addition of three new objectives in proficiency, analysis, and communications. 3. A quantitative justification for the concentration in Physics and an explanation of Meteorology as preparation for a different career trajectory. 4. Updates to course descriptions to better align them to published requirements for meteorologists in the federal civil service. <p>Upon review, CHE staff believes the curriculum proposed for the concentration has merit. Staff compared it to the curriculum for the proposed Meteorology degree. Though the number of Physics courses required was cited as the reason the Atmospheric Physics concentration needed to be offered as part of the B.S. Physics degree, and could not be added to the proposed Meteorology program, the curricula for the proposed Atmospheric Physics concentration and for the proposed Meteorology program appear to include 12 of the same Physics courses from Physics 111 through Physics 420, in addition to four of the same math courses, and the same general education requirements. As a result, there appears to be substantial duplication in the coursework between Meteorology and Atmospheric Physics.</p>

Recommendation

The staff recommends that the Committee on Academic Affairs and Licensing commend favorably to the Commission the program modification for Atmospheric Physics. However, due to program similarities including but not limited to course content, faculty qualifications, and certain program objectives shared between the proposed programs, the Bachelor of Arts in Meteorology and the Bachelor of Science in Physics with a concentration in Atmospheric Physics, CHE staff has elevated the proposed modification for Atmospheric Physics to the Committee to consider the merits of a Bachelor of Science and Artium Baccalaureatus in Meteorology with a concentration in Operational Meteorology and a second concentration in Atmospheric Physics.

PROGRAM MODIFICATION PROPOSAL

Name of Institution
College of Charleston

Name of Program (include concentrations, options, and tracks)
B.S., A.B. in Physics with a concentration in Atmospheric Physics

Program Designation

- Associate's Degree Master's Degree
 Bachelor's Degree: 4 Year Specialist
 Bachelor's Degree: 5 Year Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA)
 Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.)

Does the program qualify for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes
 No

Proposed Date of Implementation
Fall 2016

CIP Code
400801

Delivery Site(s)
College of Charleston Main Campus

Delivery Mode

- Traditional/face-to-face* Distance Education
*select if less than 50% online 100% online
 Blended (more than 50% online)
 Other distance education

Program Contact Information (name, title, telephone number, and email address)

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Institutional Approvals and Dates of Approval

Faculty Curriculum Committee, Date: 11/20/15
Faculty Senate, Date: 12/8/15

PROGRAM MODIFICATION PROPOSAL

Background Information

Provide a detailed description of the proposed modification, including its nature and purpose and centrality to institutional mission. (1500 characters)

We propose a new concentration in atmospheric physics in the B.S. Physics degree. The specificity of the math and physics courses required by this concentration make it appropriate for BS rather than our BA degree. Students in our BS program are typically interested in careers in physics and related technical fields like nuclear and electrical engineering. This new concentration in the BS program will give students this technical knowledge, as well as focused preparation in atmospheric science. The students that we anticipate completing the atmospheric physics concentration are physics students who have an ultimate goal of either attending graduate programs in atmospheric science/atmospheric physics/meteorology *and/or* pursuing more research-oriented jobs in the atmospheric sciences in research institutions like NASA or NOAA.

To accomplish this modification, no new courses, no additional faculty, no additional facilities, no additional library resources and no additional financial resources are required.

Students completing the concentration will have taken essentially enough physics and math to earn a BS; thus there will be little (likely no) demand for a BA version of the concentration.

Atmospheric physics is an interdisciplinary area between meteorology and physics. Given the high number of required physics courses, an atmospheric physics concentration is most efficiently mated to the BS in physics, not the BA in meteorology.

List the objectives of the modified program. (1500 characters)

1. Successful students will be able to demonstrate an understanding of the fundamental principles of atmospheric physics, which includes concepts from mechanics, electromagnetism, thermodynamics, and fluid mechanics.
2. Successful students will be able to demonstrate proficiency in utilizing appropriate computational tools to analyze and interpret atmospheric data.
3. Demonstrate proficiency in designing, conducting, and reporting results from experiments relative to topics in atmospheric physics.
4. Synthesize core knowledge and analytical tools to design a research project.
5. Demonstrate the ability to communicate atmospheric physics information effectively in written and oral form.

PROGRAM MODIFICATION PROPOSAL

Assessment of Need

Provide an assessment of the need for the program modification for the institution, the state, the region, and beyond, if applicable. (1500 characters)

The current concentration in Meteorology (which is being terminated) was implemented to serve a very diverse student base. As our program has evolved, it has become increasingly apparent that several different programs are necessary to serve the needs of these students. Now that the resources are available (following recent hires in the Physics and Astronomy department), a multifaceted request to introduce a new major (a B.A. in meteorology) as well as a new concentrations (a concentration in Operational Meteorology, to be linked to the B.A. in meteorology) are being put forth together with the repackaging of the atmospheric physics concentration to help ensure that the needs of our students are met. No program in atmospheric physics exists in South Carolina, or for that matter in the southeastern United States. Thus we anticipate the repackaging of the concentration within the B.S. degree from 'meteorology' to 'atmospheric physics' will attract students from throughout the region.

According to the Bureau of Labor Statistics, atmospheric scientist employment will increase about 10% from 2012 to 2022, with the largest expected changes in computer systems design and related services (34.7% increase) and scientific and technical consulting services (40.8% increase). Based on demand from our students and graduation rates from peer institutions nationwide that have atmospheric physics programs, we anticipate five graduates from our program per year.

Will the proposed modification impact any existing programs and services at the institution?

Yes

No

If yes, explain. (1000 characters)

The program proposed here serves a distinct student population to the related, but independent, proposal to create a BA in Meteorology and Operational Meteorology Concentration.

The Atmos. Phys. concentration is designed for very strong, quantitatively aligned students who want a full Physics degree, but also would like to have a targeted elective sequence (as prescribed by the curriculum of the concentration). This curriculum is predominantly designed for students who plan to seek graduate study in Physics, Atmospheric Science, Climate Science, Atmospheric Chemistry, or related fields.

Conversely, the BA in Meteorology is designed more for both future forecasters/meteorologists as well as the more diverse liberal arts student base that may be double majoring with another (potentially non-quantitative) field.

Although the BA does require a substantial amount of quantitative coursework, there is a great deal of required course content in the Physics BS that benefits those in the Atmospheric Physics concentration that may not be necessary nor desired among students obtaining the BA in Meteorology.

The only envisioned impact of this proposed concentration on the proposed Meteorology program would be to increase the total enrollment in some of the courses shared between the two programs. Since these courses have thus far had quite modest enrollment, this should not result in the need to devote additional instructional resources.

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Since this new concentration is merely replacing an existing concentration, there is no expected impact on any other existing programs or courses. All courses required in this concentration are regular offerings within the Physics and Astronomy department, and all electives are already offered as part of other degree programs and/or concentrations. Since this concentration is developed to replace an existing concentration, enrollment numbers in existing classes are not expected to appreciably change.

PROGRAM MODIFICATION PROPOSAL

List of Similar Programs in South Carolina

Program Name	Institution	Similarities	Differences
No atmospheric physics programs exist in SC, but some related programs offer a few of the courses			
Applied Physics Major with Concentration in Environmental Physics	Coastal Carolina University	Involves coursework associated with the quantitative physical sciences related to fluids, remote sensing, and atmospheric physics. Includes some of the same introductory/intermediate coursework.	Isn't designed as an atmospheric physics program; Designed for very different population.
Environmental Science B.S.	University of South Carolina	Involves some coursework associated with introductory physics coupled with natural science coursework in the environmental sciences.	Not aimed at students seeking careers in atmospheric physics. This is a much broader program.
Geology B.S. with Environmental Science Concentration	Clemson University	Closest program at Clemson to what is proposed here; involves study of Earth system as a whole, includes some environmental science classes, which may include some elements of atmospheric science.	Much more pronounced focus on Earth history and standard Geological topics. No required coursework in atmospheric science.
Environmental Studies Major	Wofford College	Program includes some elements of Natural Science investigation to elements of Earth science.	Program not targeted to atmospheric physics. Designed to be a blend of Social Science, Humanities, and Science courses within the Environmental designation.

PROGRAM MODIFICATION PROPOSAL

Description of the Program

Projected Enrollment						
Year	Fall		Spring		Summer	
	Headcount	Credit Hours	Headcount	Credit Hours	Headcount	Credit Hours
2016-2017	20	80	20	80	2	6
2017-2018	20	80	20	80	2	6
2018-2019	20	80	20	80	2	6
2019-2020	20	80	20	80	2	6
2020-2021	20	80	20	80	2	6

Curriculum

Attach a curriculum sheet identifying the courses required for the program.

The proposed Atmospheric Physics Concentration within the Physics B.S. degree will consist of 18 hours (9 core credits and 9 elective credits).

Core Courses (all required) (9 credits):

1. **PHYS 405** (Thermal Physics) (3 cr.)
(PR: PHYS 230 and (MATH 323 or PHYS 272) or permission of instructor.)
2. **PHYS 415** (Fluid Mechanics) (3 cr.)
(PR: (MATH 323 or PHYS272) and PHYS 301 or permission of instructor.)
3. **PHYS 459** (Cloud and Precipitation Physics) (3 cr.)
(PR: (PHYS 112 or HONS 158); CO: (MATH 323 or PHYS 272), or permission of the instructor)

Electives (at least 9 credits from the following list)

1. **ASTR 306** (Planetary Astronomy) (3 cr.)
(PR: ASTR 231)
2. **ENVT 352*** (Special Topics in Environmental Science and Studies) (1-4 cr.)
(CO or PR: At least 3 courses in environmental studies minor).
3. **GEOL 442** (Geological Application of Remote Sensing) (4 cr.)
(PR: GEOL 103; GEOL 105 or HONS 155 and 156. Some computer experience is helpful.)
4. **GEOL 449** (Geographical Information Systems) (4 cr.)
(PR: GEOL 103; GEOL 105 or HONS 155 and 156; or permission of the instructor. Some computer experience is helpful.)
5. **HONS 390*** (Special Topics) (3-6 cr.)
(PR: varies)
6. **PHYS 210** (Introduction to Air Pollution) (3 cr.)
(PR: PHYS 105, or PHYS 106L with a grade of C- or better, or permission of the instructor)
7. **PHYS 215** (Synoptic Meteorology) (3 cr.)
(PR: MATH 120 and (PHYS 101 (with a grade of C- or better) or PHYS 105 or PHYS 111 or HONS 157), or permission of the instructor)
8. **PHYS 225** (Climate) (3 cr.)
(PR: PHYS 112 or HONS 158 or (PHYS 102 (with a grade of C- or better) and (MATH220 or MATH229) or Permission of Instructor.)
9. **PHYS 298*** (Special Topics) (1-3 cr.)

PROGRAM MODIFICATION PROPOSAL

- (PR: Instructor and department chair permission)
10. **PHYS 320** (Intro to Electronics) (4 cr.)
(PR: (PHYS 102 and MATH 120) or PHYS 112 or PHYS 158 or Permission of Instructor.)
 11. **PHYS 340** (Photonics) (4 cr.)
(PR: PHYS 112 or HONS 158 or Permission of Instructor.)
 12. **PHYS 350** (Energy Production) (4 cr.)
(PR: CHEM 111 and (PHYS 112 or HONS 158 or [PHYS 102 and MATH 120]))
 13. **PHYS 381*** (Internship) (1-4 cr.)
(PR: PHYS or METR Majors and PHYS 370 or permission of the coordinator)
 14. **PHYS 390*** (Research) (1-3 cr.)
(PR: Permission of the instructor and chair.)
 15. **PHYS 394/394L** (Digital Signal and Image Processing with Biomedical Applications) (4 cr.)
(PR: (PHYS 112 and PHYS 112L) or (HONS 158 and HONS 158L).)
 16. **PHYS 399*** (Tutorial) (3 cr.)
(PR: Junior standing plus permission of the tutor and the department chair.)
 17. **PHYS 410** (Electricity and Magnetism 2) (3 cr.)
(PR: PHYS 409)
 18. **PHYS 412*** (Special Topics) (1-3 cr.)
(PR: Permission of the instructor.)
 19. **PHYS 420*** (Senior Research) (3 cr.)
(PR: PHYS 419 and permission of instructor and chair).
 20. **PHYS 425** (Mesoscale Meteorology) (3 cr.)
(PR: MATH 221 and PHYS 215, or permission of the instructor)
 21. **PHYS 457** (Satellite Meteorology) (3 cr.)
(PR: (One of the following: [PHYS459; PHYS425; PHYS230; PHYS225; PHYS215; PHYS210; PHYS106 (with a grade of C- or better); PHYS105] and one of the following: [PHYS102 (with a grade of C- or better); PHYS112; HONS158] and one of the following: [MATH220; MATH229]; or permission of the instructor))

* = topics in these courses must involve atmospheric physics and must be approved by the department

Curriculum Changes

Note: Complete this table only if there are changes to the curriculum.

There are no changes to the B.S. in Physics Curriculum that constitute a removal or addition of a new course.

However, minor revisions to the course descriptions of PHYS 370 (Experimental Physics), PHYS 405 (Thermal Physics), and PHYS 415 (Fluid Mechanics) will be made so that the course descriptions are better aligned with the published requirements for meteorologists in the federal civil service. These revisions do not constitute a substantial change to the nature or content of these courses (90%+ of each of the courses remain unchanged, and all usual instructors of these courses have approved the minor necessary changes).

Courses Eliminated from Program	Courses Added to Program

PROGRAM MODIFICATION PROPOSAL

Faculty

Provide a brief explanation of any additional institutional changes in faculty and/or administrative assignment that may result from implementing the proposed program modification. (1000 characters)

N/A

Resources

Identify any new library/learning resources, new instructional equipment, and new facilities or modifications to existing facilities needed to support the modified program. (2000 characters)

N/A

PROGRAM MODIFICATION PROPOSAL

Financial Support

Estimated New Costs by Year						
Category	1st	2nd	3rd	4th	5th	Total
Program Administration	0	0	0	0	0	0
Faculty and Staff Salaries	0	0	0	0	0	0
Graduate Assistants	0	0	0	0	0	0
Equipment	0	0	0	0	0	0
Facilities	0	0	0	0	0	0
Supplies and Materials	0	0	0	0	0	0
Library Resources	0	0	0	0	0	0
Other*	0	0	0	0	0	0
Total	0	0	0	0	0	0
Sources of Financing						
Category	1st	2nd	3rd	4th	5th	Total
Tuition Funding	\$51,792	\$51,792	\$51,792	\$51,792	\$51,792	\$258,960
Program-Specific Fees						
State Funding (i.e., Special State Appropriation)*						
Reallocation of Existing Funds*						
Federal Funding*						
Other Funding*						
Total						\$258,960
Net Total (i.e., Sources of Financing Minus Estimated New Costs)						\$258,960

*Provide an explanation for these costs and sources of financing in the budget justification.

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Budget Justification

Provide a brief explanation for the other new costs and any special sources of financing (state funding, reallocation of existing funds, federal funding, or other funding) identified in the Financial Support table. (1000 characters)

Note: Institutions need to complete this budget justification *only* if any other new costs, state funding, reallocation of existing funds, federal funding, or other funding are included in the Financial Support table.

There are no new costs to this concentration. It is replacing an existing concentration.

All of the required and elective courses in this concentration are either required for the BS in Physics degree or the proposed BA in meteorology degree. These courses must be taught for those audiences, regardless of whether the atmospheric physics concentration exists. We only expect perhaps a half dozen graduates with this concentration per year, and this number of students can join the existing classes as they rarely get close to the room size. Furthermore, all of these classes are currently servicing the existing concentration in meteorology within the BS in physics, which is being replaced by the new concentration.

Evaluation and Assessment

Will any the proposed modification impact the way the program is evaluated and assessed?

- Yes
 No

If yes, explain. (1000 characters)

Will the proposed modification affect or result in program-specific accreditation?

- Yes
 No

If yes, explain; if the modification will result in the program seeking program-specific accreditation, provide the institution's plans to seek accreditation, including the expected timeline for accreditation. (500 characters)

Will the proposed modification affect or lead to licensure or certification?

- Yes
 No

If yes, explain how the program will prepare students for licensure or certification. (500 characters)

PROGRAM MODIFICATION PROPOSAL

Teacher or School Professional Preparation Programs

Is the proposed modified program a teacher or school professional preparation program?

Yes

No

If yes, complete the following components.

Area of Certification

Attach a document addressing the South Carolina Department of Education Requirements and SPA or Other National Specialized and/or Professional Association Standards.