

THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE  
FACULTY SENATE

Senate Document Number 0718F  
Date of Senate Approval 11/01/18

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Statement of Faculty Senate Action:

**APC Document 3 (PHYS/ASTR):**     **Rename the Department of Physics to the Department of  
Physics and Astronomy;  
Move the catalog listing for the Astronomy minor into the  
section for Physics**

**Effective Date: Fall 2019**

**1. Delete:** On page 258, the program description for **Physics:**

**PHYSICS (PHYS)**

Professors Booker (Chair), Bennett, Ruiz; Assistant Professors Lundgren, Perkins; Senior Lecturer Beck

The Department of Physics offers a range of concentrations well suited to students intending to pursue advanced work in graduate school, careers in industry or government, or the teaching of science within the public school system. Students may elect one of four concentrations: Preparation for Graduate School, Applied Physics, Physics with Teacher Licensure, and Physics with Comprehensive Science Licensure.

The department is dedicated to excellence in undergraduate instruction. The professional interests of the faculty cover a wide range of current research in physics and physical science, and the size of the department affords ample opportunity for the close student-faculty contact we consider a major asset of our program at UNCA.

**Add:** On page 258, in place of deleted entry:

**PHYSICS (PHYS) AND ASTRONOMY (ASTR)**

Professors Booker (Chair), Bennett, Ruiz; Assistant Professors Lundgren, Perkins; Senior Lecturer Beck

The Department of Physics and Astronomy offers a range of concentrations well suited to students intending to pursue advanced work in graduate school, or careers in education, industry, government, and science communication. Students may elect one of four concentrations: Preparation for Graduate School, Applied Physics, Physics with Teacher Licensure, and Physics with Comprehensive Science Licensure.

The department is dedicated to excellence in undergraduate instruction. The professional interests of the faculty cover a wide range of current research in physics and astronomy, and the size of the department affords ample opportunity for the close student-faculty contact we consider a major asset of our program at UNC Asheville.

The department offers a wide range of activities and opportunities in physics and astronomy. Our elective classes and rigorous curricula provide excellent formal introductions to these fields of study. In addition to coursework, a multitude of research opportunities on campus enable students to work hands on with advanced instruments (for example in: electron microscopy, spectroscopy, lasers and optics, and acoustics) and to explore cutting-edge data from telescopes in space and on the ground.

The Physics major and Astronomy minor complement related natural sciences and liberal arts offerings at UNC Asheville, with the goal of broadening students' scientific perspectives through the application of scientific methods and knowledge to empirical observations of the universe. The various physics major concentrations offer students flexibility to tailor their electives towards advanced study, applied fields, or careers in education, outreach, and teaching. The astronomy minor facilitates two paths: one is designed for physical science majors and provides a rigorous preparation suitable for graduate studies in physics and astrophysics; the other is open to students of all majors, who are interested in a comprehensive study of astronomy from historical and applied perspectives. Students with a professional interest in astronomy are encouraged to combine the astronomy minor with a physics major, since a thorough grounding in fundamental physics is required for graduate studies in astronomy. As graduate programs increasingly prefer students to have undergraduate research experience, many students supplement the required coursework with independent undergraduate research.

Students pursuing the Astronomy minor at UNC Asheville have access to unique research and outreach facilities, such as the on-campus Lookout Observatory, which offers free public observing nights each month, weather permitting, and where many of our students are also employed part-time as docents. Through our faculty's active participation in external research collaborations, our students additionally benefit from access to exclusive data from the Sloan Digital Sky Survey and the Hubble Space Telescope. UNC Asheville is a member institution in the North Carolina Space Grant Consortium, which provides funds to support educational research and projects, and our students are eligible to apply for North Carolina Space Grant scholarships.

2. **Delete:** On pages 83-84, the entire entry for the **Astronomy Minor**.

3. **Add:** On page 259, before the entry for **Minor in Physics**:

#### **Minor in Astronomy**

At least 18 hours in Astronomy: ASTR 102, 103, 112, 113, 320; and 2 courses from ASTR 301, 321, 420 and 430. Note that ASTR 321 and 430 have prerequisites of PHYS 221 and either PHYS 231 or 222.

University-wide minimum requirements for a minor: 1) one-half of the hours required for a minor must be completed in residence at UNC Asheville, to include at least 6 hours at the 300-400 level; 2) students must have a cumulative grade-point-average of at least 2.0 on minor courses taken at UNC Asheville.

4. **Add:** On page 259, before the listing of **Courses in Physics (PHYS)**:

#### **Courses in Astronomy (ASTR)**

##### **102 Introduction to Astronomy: The Solar System (3)**

An introductory course covering the formation, characteristics, and motions of objects in our solar system. Additional topics include the historical development of astronomy, extra-solar planets, and telescopes. No credit given to students who have credit for ASTR 101 or ASTR 105. Fall.

##### **103 Introduction to Astronomy: Stars and Galaxies (3)**

An introductory course covering stars and their evolution, galaxies, and cosmology. Additional topics include fundamental forces in nature, nuclear reactions, origin of the elements, atomic spectra, and black holes. No credit given to students who have credit for ASTR 101 or 105. Spring.

- 112 Astronomy Lab I (1)**  
A laboratory course using observational and measurement methods employed in the field of astronomy. Students will observe the current sky with additional emphasis on solar system objects and the techniques used to study them. No credit given to students who have credit for ASTR 111. Pre- or corequisite: ASTR 102 or 103. Fall.
- 113 Astronomy Lab II (1)**  
A laboratory course using observational and measurement methods employed in the field of astronomy. Students will observe the current sky with additional emphasis on galactic and extra-galactic objects and the techniques used to study them. No credit given to students who have credit for ASTR 111. Pre- or corequisite: ASTR 102 or 103. Spring.
- 301 Indigenous Perspectives on the Sky (4)**  
Astronomy is the oldest science; it is also inherently interdisciplinary, as astronomical phenomena can be found interwoven within the economics, politics, art, religion and rituals, and philosophies of all civilizations. This course will explore how non-Western and indigenous peoples have observed, conceptualized, and utilized the celestial patterns in the sky. Special emphasis will be placed on the cosmography and astronomical knowledge of the Eastern Band of Cherokee Indians and other indigenous peoples from the Americas. The course will include numerous invited talks from tribal elders, along with substantial reading and discussions. Contextualization of the indigenous cosmographies presented in class will be achieved in the accompanying laboratory component, which will focus on semester-long naked-eye observations of celestial motions. Odd years Fall.
- 320 Observational Astronomy I (4)**  
Provides a broad introduction to methods in observational astronomy, including techniques used to measure a wide range of observable astrophysical processes across the electromagnetic spectrum (from gamma rays to radio astronomy). The lab component of the course focuses on project-based investigations on topics of the students' choosing, utilizing the optical capabilities of the university telescope at Lookout Observatory. Prerequisite: ASTR 112 or 113. Fall.
- 321 Astrophysics (3)**  
Physical processes applied to astronomical phenomena, including star formation, stellar structure and evolution, and compact stellar remnants. The interstellar medium, from which stars form, will also be examined. Prerequisites: ASTR 103 and PHYS 221. Pre- or corequisite: PHYS 222 or 231. Even years Spring.
- 420 Observational Astronomy II (3)**  
Provides an introduction to computational methods in observational astronomy. The class will be structured as a project-based exploration of professional astronomy data. No previous computing experience is required, but the course content will rely heavily on computer-based projects. The course includes an introduction to basic command-line programming (Unix and Python), statistical analysis, and data visualization, all placed within the context of astrophysical investigations. Prerequisites: ASTR 320. Odd years Spring.

**430 Black Holes and Cosmology (3)**

Basic gravitational physics of black holes, and the large scale evolution of the universe, including evidence for the Big Bang Model. Galaxies and the intergalactic medium will be an essential part of this discussion. Prerequisites: ASTR 103 and PHYS 221. Pre- or corequisite: PHYS 222 or 231. Even years Fall.

**171-4, 271-4, 371-4, 471-4 Special Topics in Astronomy (1-4)**

Courses not otherwise included in the catalog listing but for which there may be special needs. May be repeated for credit as often as permitted and as subject matter changes. See department chair.

**178 Liberal Arts First-Year Seminar (LA 178) (3-4)**

Course offered to fulfill Liberal Arts Core requirement. See Liberal Arts section of catalog for course description. May not be used to fulfill major or minor requirements.

**Impact:** There is no impact on the staffing of our Physics and Astronomy course offerings. There is no impact on other UNCA departments and their offerings; we are not changing the prerequisites. We're also not changing any course offerings for the Physics major or the Astronomy minor. We are just consolidating the two fields into one department, the Department of Physics and Astronomy.

**Rationale:** We are requesting that the name of the Department of Physics be changed to the Department of Physics and Astronomy. Physics Department faculty currently teach all the UNCA Astronomy courses. These faculty are housed in the Physics Department, yet they also teach Astronomy courses. This has been the situation since the early 1970's when the first Introductory Astronomy course was taught. And it continued to be the case when the Astronomy Minor was first developed in 2007, and was also the case when the Astronomy Minor was revised in 2016. Astronomy is also now a huge part of our department's outreach to the community with monthly observing sessions held at Lookout Observatory for the benefit of the community. These sessions draw large crowds and are very popular.

All the funding for the Astronomy courses, for equipment and supplies, comes from the Physics Department budget. So you see that the Astronomy Minor and the Physics Department have been intimately related for many years. There wouldn't be an Astronomy Minor without the Physics Department to teach its courses and to fund its equipment and supplies. The Astronomy Minor was started by members of the Physics Department. The connection between the two has been there all these years. But it was not so evident on paper.

Therefore, we are requesting that the name of the Department of Physics be changed to the Department of Physics and Astronomy. This will reflect the true connection between these two fields at UNCA. Most U.S. institutions that offer undergraduate major or minor degrees in Astronomy are referred to as Departments of "Physics and Astronomy". Based on a list on the American Astronomical Society website of Astronomy degree granting institutions (including minors, concentrations, and majors), the totals of department names by type are:

76 "Physics and Astronomy"

37 "Astronomy" (or some variant)

27 "Physics" (or some variant without the name "Astronomy").

Liberal arts examples of “Physics and Astronomy” departments include: Amherst, Carleton, Pomona, Haverford, Hanover, Macalester, Bowdoin, Bates, University of Wisconsin- Eau Claire, etc.

R-1 university examples of “Physics and Astronomy” departments include: UNC Chapel Hill, Appalachian State, Dartmouth, Northwestern, John Hopkins, UCLA, University of Southern California, Purdue, University of Tennessee Knoxville, Vanderbilt, Iowa, Michigan State, Rutgers, Stony Brook, UC Riverside, Rochester, Minnesota, Pittsburgh, Rice, Utah, Iowa State, South Carolina, Clemson, Georgia State, New Mexico, Washington State, Wyoming, Mississippi State, Kentucky, Pennsylvania, Georgia, Oklahoma, Colgate, Sacramento, Swarthmore, Mississippi, Maine, etc.

Physics is the science that describes processes that go on in Astronomy, such as describing the nature of different types of radiation from space, the explosions of supernovae, the glowing of nebulae, the motion and formation of galaxies, properties of black holes, and even the events that unfolded after the formation of the universe. Much of our fundamental understanding of modern physics (for example, gravity, dark matter, dark energy, and the origin of the elements) has been either revealed or confirmed through astronomical observations.

Our Astronomy Minor students conduct research and make observations through our two large telescopes mounted at Lookout Observatory on the UNCA campus. The director of the Observatory is housed in the Physics Department. He runs the observatory and schedules community viewings of at least one per month. Here again we have someone connected to Astronomy who is operating out of the Physics Department. The construction of Lookout Observatory has greatly expanded student interest in astronomy and astrophysics at UNCA.

Currently, during the Fall 2018 semester, the Physics department teaches 783 SCH (student credit hours) that are coded ASTR. The Physics department is currently teaching 1544 SCH that are coded PHYS. The total of these for the department is 2327 SCH, of which 34% are coded as ASTR courses. So our astronomy courses make up a sizable fraction of the teaching in our department – about a third of our SCH are devoted to teaching ASTR courses now.

Additionally, astronomy serves as an avenue for improving the demographic diversity of the **Physics** major. Currently, the upper-level astronomy courses (which require our students to enroll in a strong foundation of physics courses since they act as pre-requisites for these courses) have a 2/3 female enrollment.