THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE
FACULTY SENATE

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Statement of Faculty Senate Action:

APC Document 9 (ASTR); Changing the Requirements for the Astronomy Minor

Effective Date: Fall 2017

1. **Delete:** On page 87, the entry for the requirements for the Astronomy Minor:

   Minor in Astronomy
   18 hours in Astronomy: ASTR 101, 111, 321, 322, 411, 412, 430, 431. Note the upper level ASTR courses have prerequisites of MATH 191, 192, 291; PHYS 221, 222.

   Add: On page 87, in place of deleted entry:

   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.

Impact Statement: The most significant impact of the changes is to increase student access to the minor. Currently, four of the courses in the minor require a substantial background in physics and math. While these courses are appropriate for students intending to pursue astronomy or astrophysics in graduate school, they have resulted in limiting participation in the minor to students who are either majoring in physical sciences or have the time and interest to take several "extra" courses as prerequisites. The proposed changes require students to choose two courses out of a menu of four, providing options for students with or without a physics and math background to minor in Astronomy. See Appendix A for a comparison of the requirements for the "old" and the "new" minor.

No major impact on staffing resources is expected. Appendix B compares the faculty contact hours required to deliver the astronomy minor for both the "old" and the "new" versions. Only five additional contact hours of faculty workload over a period of two years are required by the new version, and three of these will be absorbed by Department of Modern Languages and Literature faculty who will be team-teaching the "Indigenous Perspectives on the Sky" course.

Note that the number of sections of the introductory level of astronomy was decreased from 3 to 2 in the spring semesters. This change was made to partially compensate for the increase in faculty workload hours due to the changes in the Observational Astronomy sequence and the addition of another lab course (ASTR 301). Historically, enrollment in the spring sections of Astronomy has been lower than enrollment in the fall sections. Consolidating in the spring semesters should therefore not have a negative impact on student learning. It may also prove possible to reduce the number of lab sections in the spring semesters. (See Appendix B for the workload hours based on this option.)

Rationale: The proposed changes to the minor include: a) changing the introductory sequence from one course to two courses; b) changing the number of credit hours associated with the Observational Astronomy courses; and c) providing a menu of four courses from which students will choose two to fulfill requirements. The rationale for each change will be addressed separately.

a) The amount of material in introductory astronomy is too much for one semester, resulting in a superficial treatment of many of the topics. Many, if not most, colleges and universities with astronomy curricula offer two introductory courses, one focusing on the solar system and the second on stars and galaxies. Having two introductory courses will provide a better foundation for students choosing to minor in astronomy.

b) The hands-on nature of Observational Astronomy I is designed to cultivate scientific curiosity and critical thinking in a manner appropriate for all students with a basic knowledge of astronomy, regardless of their research orientation. The current version of this course is running in an under-resourced capacity due to the time-intensive project-based nature of the course and its increasing student enrollments. Increasing the credit hours from 1 to 4 will enable the addition of a much needed lecture component, in which to lay the scientific and technical foundations students need to effectively design and carry out their projects. The substantial time investments by students enrolled in previous semesters of ASTR 411 further justifies an increase in credit hours.

   Modern observational astronomy requires a basic familiarity with coding in order to interface with digital datasets of ever-increasing scale. Observational Astronomy II provides students with the opportunity to obtain these fundamental skills via open-ended explorations of authentic astrophysical data. Note that the course is scheduled for the Spring term, when weather conditions are suboptimal for utilizing the university telescope.

c) All of the upper level classes in the minor except the observational courses have had PHYS 221, 222 as prerequisites. PHYS 222 itself has MATH 191, 192, 291 as pre- or corequisites. These courses are very appropriate for students desiring to pursue graduate level study in astronomy and astrophysics. However, the additional hours of these 5 courses have in practice resulted in limiting access to the minor to students in just a few majors. The proposed changes would require students to choose two out of a menu of four courses, providing an option to complete the minor without physics background. In addition, the courses which do require physics have prerequisites of PHYS 221 and either PHYS 231 or 222 instead of PHYS 221 and 222 as were previously required. The addition of PHYS 231 as an option is consistent with the physics courses required for chemistry and computer science majors. See Appendix A for a detailed table of the courses and their pre- and corequisites.

   In summary, students intending to pursue astronomy study beyond the undergraduate curriculum will be advised to take ASTR 321 and 430. Students majoring in physics, atmospheric sciences, engineering, chemistry and computer science who choose to minor in astronomy will already have the necessary physics prerequisite courses as part of their major course of study. Students in other majors could certainly take the extra courses. However, with the new curriculum they will have the option to complete the minor by taking ASTR 301 and 420, which do not require any additional prerequisites.

   In addition to eliminating "hidden" requirements, adding a pathway that is non-physics based will create a minor program that is more interdisciplinary in nature. Broadening the curriculum will hopefully encourage participating students to make connections between astronomy and their other coursework and interests.

Flexibility is built into the curriculum to also allow participation by students not necessarily interested in pursuing a minor. For example, ASTR 301 has no prerequisites. The Observational Astronomy courses require either introductory level lab, but not both, so a student interested primarily in observation can take only one semester at the introductory level and then continue with the upper level observational courses. The physics-based upper level courses require only ASTR 103 since these courses will deal with astronomical objects and phenomena primarily from the second introductory course. Therefore, these may also be of interest to science majors who have the physics and math background but do not have room in their schedules for both introductory courses and are not pursuing the minor.

Appendix A: Astronomy Minor Requirements Comparison

Old requirements: all courses required				
Course name	**Number**	**Pre and coreqs**	**Credit hours**	**Offered**
Astronomy	ASTR 101	none	3	Every semester
Astronomy Lab	ASTR 111	ASTR 101	1	Every semester
Astrophysics I	ASTR 321	ASTR 101/111, PHYS 222*	3	Odd fall
Astrophysics II	ASTR 322	ASTR 321	3	Even spring
Observational Astronomy I	ASTR 411	ASTR 101/111	1	Even fall
Observational Astronomy II	ASTR 412	ASTR 411	1	Odd spring
Adv Topics in Astronomy I	ASTR 430	ASTR 101/111, PHYS 222*	3	Even fall
Adv Topics in Astronomy II	ASTR 431	ASTR 430	3	Odd spring

*pre and coreqs built in to PHYS 222 include PHYS 221, MATH 191,192,291

New requirements				
Course name	**Number**	**Pre and coreqs**	**Credit hours**	**Offered**
Required courses:				
Intro. to Astronomy: The Solar System	ASTR 102	none	3	Fall
Intro. to Astronomy: Stars and Galaxies	ASTR 103	none	3	Spring
Astronomy Lab I	ASTR 112	Pre or coreq: ASTR 102 or 103	1	Fall
Astronomy Lab II	ASTR 113	Pre or coreq: ASTR 102 or 103	1	Spring
Observational Astronomy I	ASTR 320	Prereq: ASTR 112 or 113	4	Fall
Choose 2 of 4:				
Indigenous Perspectives on the Sky	ASTR 301	none	4	Odd fall
Astrophysics	ASTR 321	**Prereqs: ASTR 103, PHYS 221; Coreq: PHYS 222 or 231	3	Even spring
Black Holes and Cosmology	ASTR 430	**Prereqs: ASTR 103, PHYS 221; Coreq: PHYS 222 or 231	3	Even fall
Observational Astronomy II	ASTR 420	Prereq: ASTR 320	3	Odd spring

**students majoring in PHYS, ENGR, ATMS, CHEM, and CSCI will have these physics prerequisite courses (and the associated math courses) as part of their major requirements

Appendix B: Astronomy Minor Revision: Comparison of Faculty Workload / Contact Hours

Old Astronomy Minor – Total hours over 2 years: 102

total faculty contact hours per 2 yrs: 102

Fall (Even Year)	Student Credit Hrs (per course)	Faculty Contact Hrs (total)
ASTR 101 (3 Sections)	3	9
ASTR 111 (4 Sections)	1	12
ASTR 411	1	3
ASTR 430	3	3
Total	**8**	**27**

Spring (Odd Year)	Student Credit Hrs (per section)	Faculty Contact Hrs (total)
ASTR 101 (2 Sections)	3	9
ASTR 111 (4 Sections)	1	12
ASTR 412	1	3
ASTR 431	3	3
	8	**27**

Fall (Odd Year)	Student Credit Hrs (per course)	Faculty Contact Hrs (total)
ASTR 101 (3 Sections)	3	9
ASTR 111 (4 Sections)	1	12
ASTR 321	3	3
Total	**7**	**24**

Spring (Even Year)	Student Credit Hrs (per section)	Faculty Contact Hrs (total)
ASTR 101 (3 Sections)	3	9
ASTR 111 (4 Sections)	1	12
ASTR 322	3	3
	7	**24**

New Astronomy Minor Option 1 – Total hours over 2 years: 107

total faculty contact hours per 2 yrs: 107

Fall (Even Year)	Student Credit Hrs (per course)	Faculty Contact Hrs (total)
ASTR 102 (3 Sections)	3	9
ASTR 112 (4 Sections)	1	12
ASTR 320	4	6
ASTR 430	3	3
Total	**11**	**30**

Spring (Odd Year)	Student Credit Hrs (per course)	Faculty Contact Hrs (total)
ASTR 103 (2 Sections)	3	6
ASTR 113 (4 Sections) (3)	1	12 (9)
ASTR 420	3	5
	7	**23 (20)**

Fall (Odd Year)	Student Credit Hrs (per course)	Faculty Contact Hrs (total)
ASTR 102 (3 Sections)	3	9
ASTR 112 (4 Sections)	1	12
ASTR 320	4	6
ASTR 301*	4	6
Total	**12**	**33**

Spring (Even Year)	Student Credit Hrs (per course)	Faculty Contact Hrs (total)
ASTR 103 (2 Sections)	3	6
ASTR 113 (4 Sections) (3)	1	12 (9)
ASTR 321	3	3
	7	**21 (18)**

*Indigenous Perspectives on the Sky will be co-taught; contact hours will be divided

Option 2: Decrease number of introductory lab sections offered in spring semesters from 4 to 3, resulting in **total hours over 2 years = 101**. Rationale: Traditionally, fewer students take introductory astronomy in spring semesters than in fall. Given current trends, 3 lab sections would suffice.