UMBC UGC Program Changes & Other Request: Astronomy Minor

Date Submitted: February 16, 2018 (revised) Proposed Effective Date: Fall 2018

	Name	Email	Phone	Dept
Dept Chair or UPD	Terrance Worchesky	worchesk@umbc.edu	56779	Physics
Other Contact	Eileen Meyer	meyer@umbc.edu	52534	Physics

Specifics (see instructions):

Proposed Changes to the Astronomy Minor

The table below lists the courses of the existing and proposed minor in its left and right column correspondingly. Blue signifies dropped or split, red signifies added and black signifies unchanged.

PHYS 121 Introductory Physics I (4)	PHYS 121 Introductory Physics I (4)
PHYS 122 Introductory Physics II (4)	PHYS 122 Introductory Physics II (4)
PHYS 304 Fundamentals of Astronomy (3)	PHYS 224 Vibrations & Waves (3)
	PHYS 324 Modern Physics (3)
Select 3 from these courses:	Select 3 from these courses:
PHYS 315 Galaxies and the Interstellar Medium (3)	PHYS 304: Fundamentals of Astrophysics (3)
PHYS 405 Stellar Astrophysics (3)	PHYS 405: Stellar Astrophysics (3)
PHYS 415 Astroparticle Physics (3)	PHYS 406: Extragalactic Astrophysics (3)
PHYS 425 Relativistic Physics (3)	PHYS 415: Astroparticle Physics (3)
PHYS 416 Extragalactic Astronomy & Cosmology (3)	PHYS 416: Cosmology (3)
	PHYS 425: Relativistic Physics (3)
	PHYS 499: Senior Research* (3)
Total physics credits: 20	Total physics credits: 23

**With Approved Astrophysics Faculty*

Proposed Changes

The new minor is also summarized here: http://astro.umbc.edu/~meyer/new_minor.html

a. **Changing of the Name**
To better reflect the nature of the degree (based strongly in a physics background), we propose for the minor to be renamed "Minor in Astrophysics". As noted below, this change is also propagated to all courses with "Astronomy" in the title.

b. **Changes to Base Physics Requirements**
Modern Astrophysics draws on practically all the branches of physics. To better prepare the students for upper-level astrophysics courses, the astrophysics faculty believes that physics sequence through Modern Physics is essential. Thus, we propose a base requirement of PHYS 121, 122, 224, and 324 before attempting any Astrophysics courses. We note that we drop PHYS 304 as a base or 'gateway' requirement, though it still remains as an elective survey course.

c. **Total Credits**
We propose for students to take a further three 3-credit electives in Astrophysics to complete the minor, corresponding to a (minimum) 23 hours total. In comparison, the Minor in Physics also requires 23 hours total.

d. **Count PHYS 499 (with approved Astrophysics Faculty) towards the Minor**
Many students do research projects with the Astrophysics Faculty, often earning credit in PHYS 499 Senior Research. We propose that up to 3 credits of PHYS 499 that pertains to research in astrophysics count towards the elective portion of the minor.

e. **Allow Graduate-Level Astrophysics Courses as Electives**
With approval from the faculty mentor or associate chair, suitably advanced students may be approved to register for PHYS 631/632 "The Physics of Astrophysics I/II" and have the course(s) count towards the minor.

Rationale (see instructions):

Changes to Astrophysics Courses and the Minor in Astronomy – Overview

The following consist of a series of changes to the minor degree in astronomy as well as to various aspects of the astrophysics courses offered by the Physics Department. These changes are the result of meetings over the last year by the physics faculty specializing in astrophysics, as well as the physics undergraduate curriculum committee. These changes were presented to and approved by the Physics Department. The proposed changes were prompted primarily by the fact that while a large number of students express an interest in the minor (and participate in research with astrophysics faculty), the number of minor degrees awarded has remained small (0-1 per year compared to several dozen expressing interest over all grade levels), and secondarily by the fact that many students were attempting astrophysics courses unsuccessfully due to a lack of the necessary physics background. A third consideration is to modernize the way that we teach the topics of cosmology and extragalactic astrophysics (where we propose to have two separate courses reflecting the enormous growth in research in these topics over the last decade, instead of a single course). With the following changes, we believe the rigor of the astrophysics electives will improve to the correct level and the number of students completing the astronomy minor will increase to a level commensurate with interest.

After much study, we believe that the reason few students achieved the minor in astronomy despite being prime candidates (i.e., doing research in the subject and later applying to graduate astrophysics programs) was due to the fact that PHYS 304: "Fundamentals of Astronomy and Astrophysics" was a "gatekeeper" course that had to be taken first, before any other Astronomy electives. Due to scheduling constraints, this class was usually only taught once per year, and in many cases students could not take it in the right time (first semester of junior year) due to conflicts with other courses and "missed their chance" to complete the minor. Since the creation of the minor, we have found by experience that students who have had the pre-requisite of PHYS 304 waived for other astronomy courses have not shown adverse outcomes, likely because the topics covered in the astrophysics curriculum can be taught as self-contained courses. In the newly-configured minor, PHYS 304 remains as a survey course which students will be encouraged to take first if possible, though it will not be required that they do so.

Instead of requiring PHYS 304, we have changed all astrophysics electives to require the course PHYS 324 Modern Physics (this essentially makes the first four courses of the minor PHYS 121, 122, 224, and 324). This change

reflects that the astrophysics electives cannot be taught at the 300- and 400-level if students have not first learned many of the topics covered in Modern Physics. Also, it makes the minor more in line with minors in astronomy/astrophysics at peer institutions, and with our own physics minor.

In the following pages, we have listed all the changes that have been approved at the department level. To facilitate the work of the campus-wide curriculum committee in discussing and voting on these changes, these changes are organized in the following logical sequence:

I. First, we propose the individual changes to existing courses (involving changes to pre-requisites and/or slight changes in title or description).

II. Second, we propose a new course, "PHYS 406: Extragalactic Astrophysics". This turns PHYS 416: Extragalactic Astrophysics and Cosmology into two separate courses PHYS 416: Cosmology and PHYS 406: Extragalactic Astrophysics. This fits with the present coverage of PHYS 416, an emphasis on Cosmology. Also, PHYS 406 will contain most of the material present in the PHYS 315, Galaxies and the Interstellar Medium. Thus, PHYS 315 has been removed from the list of electives for the minor. Again, creation of PHYS 406 would need to be approved prior to a change in the minor.

III. Finally, with the above coursework changes in place, we propose the changes to the existing astronomy minor, as detailed in the table.