

# PHYSICS, ASTROPHYSICS EMPHASIS, MAJOR - LIBERAL ARTS:

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## In Workflow

1. PHYSASTR Chair (hendrije@uwec.edu)
2. AS Dean PreCurrComm (PIM) (cassidml@uwec.edu; clarkmeg@uwec.edu)
3. AS Dean (PIM) (cassidml@uwec.edu; clarkmeg@uwec.edu)
4. University Senate APC (hemmeral@uwec.edu)
5. University Senate (nearytk@uwec.edu)
6. Provost/Chancellor (kleinpa@uwec.edu; beckejan@uwec.edu; forciesm@uwec.edu)
7. Institutional Research (herbiskj@uwec.edu)
8. Registrar (PIM) (langfeta@uwec.edu)
9. Degree Review (PIM) (olsoee@uwec.edu; relforml@uwec.edu; richaud@uwec.edu; olsomce@uwec.edu)
10. Reg Cat (none)

## Approval Path

1. Wed, 02 Nov 2022 03:32:07 GMT  
Erik Hendrickson (hendrije): Approved for PHYSASTR Chair
2. Thu, 10 Nov 2022 23:57:34 GMT  
Margaret Cassidy (cassidml): Approved for AS Dean PreCurrComm (PIM)
3. Wed, 07 Dec 2022 16:02:39 GMT  
Margaret Cassidy (cassidml): Approved for AS Dean (PIM)

## New Program Proposal

Date Submitted: Wed, 02 Nov 2022 03:31:04 GMT

**Viewing : Physics, Astrophysics Emphasis, Major - Liberal Arts**

**Last edit: Thu, 03 Nov 2022 19:52:02 GMT**

Changes proposed by: Erik Hendrickson (hendrije)

## Preparer(s)

### Preparer Name:

J. Erik Hendrickson

## Program Level

Undergraduate

## Program Type

Emphasis, Major

## Degree Type

BA/BS

## Name of Program

Physics, Astrophysics Emphasis, Major - Liberal Arts

## Major Type

Standard

## Administrative Department

Physics and Astronomy

## College

Arts and Sciences

## Effective Catalog Year

2023-2024

Is this content intended to be shared across multiple programs/catalog pages?

No

**Catalog Placement Notes**

Place with Physics & Astronomy Department offerings.

Introductory Paragraph:

The Astrophysics Emphasis provides preparation for astrophysics or astronomy graduate school, as well as a broad range of careers in technical fields in business/industry settings following completion of the baccalaureate degree.

**Program Requirements (Includes Course Lists):****Program Requirements (Includes Course Lists):**

Code	Title	Credits
<b>Core Requirements</b>		
The Astrophysics Emphasis requires 37-38 credits of physics coursework including:		
PHYS 186	Introductory Seminar	0.5
PHYS 226 or PHYS 229	Astronomy-Solar System Astronomy-Stars and Galaxies	4
PHYS 231	University Physics I	5
PHYS 232	University Physics II	5
PHYS 332	University Physics III	3
PHYS 333	Quantum Physics	3
PHYS 340	Optics	4
PHYS 365	Theoretical Mechanics	4
PHYS 367	Astrophysics	3
PHYS 430	Advanced Laboratory Techniques	2
Select one of the following:		3-4 credits
PHYS 445 or PHYS 375 or PHYS 465	Thermal Physics Electromagnetic Fields Quantum Mechanics	
PHYS 486	Senior Seminar	0.5
Required courses not counted toward credits in major:		
MATH 312	Differential Equations and Linear Algebra	
PHYS 240 or CS 145 or CS 163 or CS 170 or DS 150	Computational Physics <sup>1</sup> Programming for New Programmers Introduction to Programming in C++ Computing for the Sciences and Mathematics Computing in Python: Fundamentals and Procedural Programming	

<sup>1</sup> Many upper division physics courses require proficiency in Python, so PHYS 240 is preferred. If CS 145, CS 163, CS 170 or DS 150 is taken, Python proficiency will be required prior to enrollment in relevant upper division physics courses. Contact the department to complete the required programming exercise.

NOTE: An approved research project must be completed prior to PHYS 486 (see PHYS 486 course description for details).

**Additional Program Requirements (If Applicable)****Additional Admission Requirements Unique to Program (If Applicable)****Other Catalog Notes/Restrictions (If Applicable)****Learning Outcomes**

Please state the Learning Outcomes for this New Program:

	Description
Outcome 1	Qualitatively describe natural phenomena and human-made devices in terms of the basic laws of physics in areas of classical mechanics, thermodynamics, electromagnetism, optics, electronic circuits, quantum physics, and special relativity.
Outcome 2	Convert a physical situation described in English into a mathematical model.
Outcome 3	Apply the mathematical tools commonly used in physics to obtain analytical and numerical solutions to problems modeling physical situations.

Outcome 4 Design experiments and demonstrate the ability to use measurement technology, computational tools, and statistical techniques to collect and analyze data.

Outcome 5 Communicate verbally, graphically, and in writing the results of theoretical analysis, numerical computations, and laboratory experiments in a clear and concise manner that incorporates the stylistic conventions used by physicists worldwide.

Outcome 6 Synthesize appropriate concepts and methods from different courses in the solutions of problems and apply physical and mathematical principles across disciplinary boundaries.

Outcome 7 Use physical principles to model astronomical objects and to explain observations of astronomical objects.

## Summary and Rationale

### Target Audience(s)

Students with an interest in astronomy/astrophysics, especially those with an interest of attending graduate school to further study astronomy/astrophysics. The continual media highlights/stories of major astronomical discoveries, interesting observational events, and new technological advancements have increased the interest in these areas: the Hubble Space Telescope, the landings of rovers on Mars, the mysteries of black holes, the Webb Space Telescope, the possibility of alien life, the International Space Station, the potential of comet/asteroid impacts on Earth, etc.

### Evidence of long-term need

We have been asked over and over again: Since you are the Department of Physics and Astronomy, do you have an Astronomy (or Astrophysics) Major? This interest will continue long into the future. There are very few universities that offer an astronomy/astrophysics undergraduate liberal arts major.

### Anticipated Enrollment

Up to 5 graduates per year, a total of 25 students enrolled.

### Alignment with university mission

This is an integrative liberal arts major. It brings the areas of math and physics together and applies these methods to the mysteries of the physical universe.

### Statement of benefits to students

Students will gain a broad background in physics, astronomical theory, scientific computation, data analysis, and technical communication. This will prepare them for graduate school in astronomy, astrophysics, and related sciences. Their background will also be helpful in the areas of observatory and satellite operation, instrument development, and public science outreach positions at museums and planetaria.

### Department(s), program(s), college(s), and university predecessor programs

In the College of Arts & Sciences at UWEC, the Physics & Astronomy Department already offers a Physics, Liberal Arts Emphasis, Major, a Physics, Applied Emphasis, Major, a Physics, Dual Degree Engineering Emphasis, Major, and a Pre-Engineering Program.

### Relationship to existing programs

When we just had one major in the Department, students would ask us two questions all the time: If I want to go to graduate school in physics, what electives should I take? If I do not want to go to graduate school, but I want to jump directly into employment, what electives should I take? We were asked these questions so often, we created an "advising guide" to point these two groups in slightly different directions, using two separate lists of "preferred" electives from our existing course selection. Eventually, we just decided to turn the one physics major into two different emphases (Physics, Liberal Arts Emphasis, BA/BS and Physics, Applied Emphasis, BA/BS) based on these different sets of preferred electives. Fast-forward to recent history, and we have now had students ask us: If I want to go to graduate school in astronomy/astrophysics, what electives should I take? So, this new emphasis has the same "core" of physics included as the Liberal Arts Emphasis and the Applied Emphasis, it just codifies the electives that would be most useful to a person who is interested in astronomy/astrophysics (and not just going to graduate school).

## Resources

### Does the department have the necessary staffing to offer this program?

Yes

### Explain need for student support, library resources, etc.:

Current support is adequate.

### Describe funding needs to initiate and maintain the program, including source(s) of funding and any needed resource reallocation:

None.

### Proposed frequency of offering for courses included in the program:

Current core courses are offered either every semester or every year. Electives are already offered either every year or every other year.

**Proposed arrangements for ongoing faculty advising for students in the program**

We have several astrophysicists in the Department who currently advise Physics, Liberal Arts, majors and Physics, Applied, majors. We would shift the allocation of these majors to others in the Department, as we start to assign the new Physics, Astrophysics, majors to these advisors.

**Provide justification that this program is not a duplication of another program that is currently being offered**

There is currently no other program at UWEC with an emphasis on astronomy/astrophysics.

**If applicable, select impacted departments:**

**Departments**

Computer Science

Mathematics

**Describe impacted courses or programs in other areas of the university:**

Possibly a few more students in specific courses:

Math 312 is a required course for this new emphasis.

Math 114 and Math 215 and Math 216 are pre-requisites for required courses within this new emphasis.

CS 145 or CS 163 or CS 170 are options within this new emphasis (the emphasis says it prefers Phys 240 – Python, but we want to leave this flexibility in the emphasis).

I have contacted the Chairs of these 2 Departments, letting them know of this proposal and asking for their comments/concerns, if any. Responses have indicated no concerns.

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