

MINOR IN ASTRONOMY

The Minor in Astronomy is ideal for students who want to explore astronomy beyond a lower-division survey course. To be admitted to the Minor in Astronomy, students must complete either (i) MATH 198 or MATH 199, or (ii) both MATH 226 and MATH 227, depending on the choice of physics sequences.

Program Learning Outcomes

- Describe universal physical principles in classical mechanics, electricity & magnetism, special & general relativity, thermodynamics & statistical mechanics, quantum mechanics, astronomy & astrophysics, and relate fundamental conservation principles (conservation of energy, conservation of linear momentum, conservation of angular momentum) to underlying symmetries of nature.
- Analyze real-world physical systems on Earth and throughout the Universe, develop simplified models of such systems, translate physical principles into the language of mathematics, and then apply the appropriate mathematical tools (vector calculus, linear algebra, differential equations, variational techniques, probability & statistics, numerical & computational methods) to determine a system's spatiotemporal evolution with an awareness of the limitations of any solutions due to the approximations of the physical models and/or mathematical/computational techniques.
- Demonstrate proficiency with basic laboratory skills and experimental techniques with electronics, lasers & optical devices, sensors, detectors, microscopes, and telescopes, always with appropriate safety practices (especially with respect to lasers, chemicals, and radioactive materials).
- Articulate and apply the "scientific method," the empirical, iterative method of acquiring new knowledge through developing models to explain observations of the natural world, formulating testable hypotheses, designing and executing experimental, computational, and theoretical investigations to test predictions, analyzing data with appropriate statistics and attention to uncertainties, ascertaining consistency with existing theories, and sharing results with the broader scientific community for confirmation and validation.
- Demonstrate writing, speaking, and visual data presentation skills to effectively communicate science at the appropriate level of sophistication for the relevant target audience (e.g., instructors, students, scientists, public-at-large, policy-makers).
- Develop the social and communication skills to effectively participate in diverse scientific teams, including those that are multidisciplinary and/or interdisciplinary, and appreciate that the pursuit of science is a human endeavor and that progress is best made when the full spectrum of humanity is encouraged to participate and share their perspectives, passions, and skills.
- Engage local, state, national & global communities to address current and emerging scientific and technological challenges in equitable and environmentally sustainable ways.

Astronomy Minor – 20 units

- Lower-division courses must be taken for letter grades and be passed with grades of C or better.
- ASTR 300 and ASTR 301 must be taken for letter grades and passed with grades of C-minus or better.

- Electives may be taken for letter grades or on a CR/NC basis in courses where CR/NC is allowed.
- All coursework used to satisfy the requirements of the minor must be completed with a minimum grade point average of 2.0.
- A minimum of 6 upper-division units are required to complete the minor.

Required Courses (17 units)

Code	Title	Units
Select One:		4
PHYS 111 & PHYS 112	General Physics I and General Physics I Laboratory	
PHYS 220 & PHYS 222	General Physics with Calculus I and General Physics with Calculus I Laboratory	
Select One:		4
PHYS 121 & PHYS 122	General Physics II and General Physics II Laboratory	
PHYS 230 & PHYS 232	General Physics with Calculus II and General Physics with Calculus II Laboratory	
PHYS 240 & PHYS 242	General Physics with Calculus III and General Physics with Calculus III Laboratory	
ASTR 115 & ASTR 116	Introduction to Astronomy and Astronomy Laboratory	4
ASTR 300	Stars, Planets, and the Milky Way	3
ASTR 301	Observational Astronomy Laboratory	2

Electives (3 units)

Take one upper-division ASTR or PHYS course. Students may choose an upper-division elective in EARTH or other related fields with prior approval from a faculty advisor.