

# Astronomy (ASTR)

## Courses

### ASTR 007 Introduction to Astronomy 3 Credits

Introduction to planetary, stellar, galactic, and extragalactic astronomy. An examination of the surface characteristics, atmospheres, and motions of planets and other bodies in our solar system. Properties of the sun, stars, and galaxies, including the birth and death of stars, stellar explosions, and the formation of stellar remnants such as white dwarfs, neutron stars, pulsars, and black holes. Quasars, cosmology, and the evolution of the universe. May not be taken by students who have previously completed ASTR 105, PHY 105, ASTR 301, PHY 301, ASTR 302 OR PHY 302.

**Attribute/Distribution:** NS

### ASTR 008 Introduction to Astronomy Laboratory 1 Credit

Laboratory to accompany ASTR 007. Must be enrolled concurrently in ASTR 007.

**Corequisites:** ASTR 007

**Attribute/Distribution:** NS

### ASTR 091 Special Topics in Astrophysics 1-4 Credits

Selected topics not sufficiently covered in other courses.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** NS

### ASTR 105 Introduction to Planetary Astronomy 3 Credits

This course is an introduction to the solar system. Topics include observations of the sky, transition from the geocentric to the heliocentric paradigm, gravitational interactions, formation and evolution of the solar system, the structure of and energy production in the Sun, survey of the planets in the solar system, including their dynamics, interiors, atmospheres, composition, and moons, the nature of asteroids, comets, and the Kuiper belt, and the study of exoplanets. Instructor permission required in lieu of Phy 5/10/11.

**Prerequisites:** PHY 005 or PHY 010 or PHY 011

**Attribute/Distribution:** NS

### ASTR 191 Special Topics in Astrophysics 1-4 Credits

Selected topics not sufficiently covered in other courses.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** NS

### ASTR 273 Research 2-3 Credits

Participation in current research projects being carried out within the department.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** NS

### ASTR 291 Special Topics in Astronomy 1-4 Credits

Selected topics not sufficiently covered in other courses.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** NS

### ASTR 300 Apprentice Teaching 3 Credits

### ASTR 301 Introduction to Stellar Astrophysics 3 Credits

This course will take an observational, theoretical, and computational perspective to investigate the physics of stars. Students will learn how to measure fundamental stellar properties (distance, brightness, mass, radius, and temperature). Students will combine astronomical data analysis with physical modeling, including applications from classical mechanics, quantum mechanics, thermodynamics, electromagnetism, and nuclear physics, to describe the atmosphere, internal structure, energy generation, and evolution of stars. Additional topics include: binary stars, variable stars, supernovae, white dwarfs, neutron stars, pulsars, and black holes.

**Prerequisites:** (PHY 010 or PHY 011) and (PHY 013 or PHY 021 or PHY 023) and PHY 031 and (MATH 022 or MATH 032 or MATH 052)

**Attribute/Distribution:** NS

### ASTR 302 Introduction to Galactic and Extragalactic Astrophysics 3 Credits

This course covers the astrophysics of the universe from stars to cosmological structure. We explore star clusters and stellar populations, and examine the components, structure, and dynamics of the Milky Way Galaxy. We investigate galactic morphology, classification, and evolution, including active galaxies and quasars. The course concludes with a short introduction to cosmology and an overview of galaxy clusters and intergalactic structure.

**Prerequisites:** (PHY 010 or PHY 011) and (PHY 013 or PHY 021 or PHY 023) and (MATH 022 or MATH 032 or MATH 052) and ASTR 301

**Attribute/Distribution:** NS

### ASTR 332 (PHY 332) High-Energy Astrophysics 3 Credits

Observation and theory of X-ray and gamma-ray sources, quasars, pulsars, radio galaxies, neutron stars, black holes. Results from ultraviolet, X-ray and gamma-ray satellites. Generally offered in the spring of odd-numbered years.

**Prerequisites:** PHY 021 and (MATH 023 or MATH 033) and PHY 031 and PHY 215

**Can be taken Concurrently:** MATH 023, MATH 033

**Attribute/Distribution:** NS

### ASTR 342 (PHY 342) General Relativity 3 Credits

An introduction to Einstein's theory of general relativity. Topics covered: the geometry of spacetime; curvature and the gravitational field equations; the Schwarzschild and Kerr black holes and more general spacetime geometries; black hole thermodynamics; gravitational waves; the Friedmann–Robertson–Walker geometry and inflationary cosmology; dark energy and the cosmological constant problem.

**Prerequisites:** (PHY 021) and (MATH 023 or MATH 033) and PHY 215

**Can be taken Concurrently:** MATH 023, MATH 033, PHY 215

**Attribute/Distribution:** NS

### ASTR 344 Cosmology 3 Credits

This course covers the large-scale evolution of our universe from the big bang until today and into the far future. Topics covered: Hubble expansion, Friedman equations, Einstein's biggest blunder, dark energy, dark matter, the standard model of cosmology (the so-called  $\Lambda$ CDM model), the cosmic microwave background, nucleosynthesis and inflation.

**Prerequisites:** PHY 021 and (MATH 023 or MATH 033) and PHY 215

**Can be taken Concurrently:** MATH 023, MATH 033, PHY 215

**Attribute/Distribution:** NS

### ASTR 389 Honors Project 1-6 Credits

**Repeat Status:** Course may be repeated.

### ASTR 391 Special Topics in Astronomy 1-4 Credits

Selected topics not sufficiently covered in other courses.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** NS

### ASTR 491 Special Topics in Astronomy 1-4 Credits

Selected topics not sufficiently covered in other courses.

**Repeat Status:** Course may be repeated.