

# ASTRONOMY AND ASTROPHYSICS

Department of Physics and Astronomy  
College of Natural Science

## 101 The Celestial Clockworks

Spring. 1(1-0)  
Relationship between ancient skylore and timekeeping. Establishment of a calendar and celestial navigation. Development of the Greek horoscope as a time recorder and coordinate system.

## 207 The Science of Astronomy

Fall. 3(3-0) P:M: ((PHY 231 or concurrently) or (PHY 231B or concurrently) or (ISP 205 or concurrently) or (PHY 181B or concurrently) or (PHY 183 or concurrently) or (PHY 183B or concurrently) or (LBS 271 or concurrently) or (PHY 231C or concurrently)) and ((MTH 116 or concurrently) or (MTH 114 or concurrently) or (LBS 117 or concurrently)) Not open to students with credit in AST 201.

In-depth study of one topic in astronomy with emphasis on key discoveries. Topics may be cosmology, the solar system, and the life of stars. Observing with portable telescopes.

## 208 Planets and Telescopes

Spring. 3(2-2) P:M: (PHY 183 or PHY 183B or PHY 193H) and (MTH 132 or MTH 152H or LBS 118) RB: AST 207 Not open to students with credit in AST 303.

Origin and nature of the solar system. Planets of the solar system and other star systems. Determination of time and celestial coordinates. Astronomical instruments and observational methods.

## 301 Junior Research Seminar

Fall, Spring. 1(1-0) P:M: Completion of Tier I writing requirement.  
Preparation and presentation of a review paper on a current topic in astronomy or astrophysics.

## 303 Planetary System Astronomy

Fall of even years. 3(3-0) P:M: (PHY 183 or PHY 193H or PHY 183B) and (MTH 132 or MTH 152H or LBS 118) SA: AST 201

Origin and nature of the solar system. Planets of the solar system and other star systems. Asteroids, meteorites, and comets. Determination of time and celestial coordinates.

## 304 Stars

Fall of even years. 3(3-0) P:M: AST 208 and PHY 215 and (PHY 321 or concurrently) SA: AST 401

Physical processes that determine the structure and evolution of stars. Observations of stars and star clusters. Spectra of stars.

## 307 The Milky Way

Fall of odd years. 3(3-0) P:M: (PHY 183 or PHY 193H or PHY 183B) and (MTH 132 or MTH 152H or LBS 118) SA: AST 202

Structure and history of the Milky Way Galaxy. Stellar populations. Interstellar medium.

## 308 Galaxies and Cosmology

Spring of odd years. 3(3-0) P:M: AST 208 and PHY 215 and (PHY 321 or concurrently) SA: AST 402

The Milky Way. Structure and content of galaxies. Active galaxies and quasars. The expanding universe. Modern cosmological models.

## 310 Directed Studies

Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department.

Individual study or project in astronomy or astrophysics under the direction of a faculty member.

## 312 Observational Astronomy

Spring. 1(0-2) P:M: AST 303 or AST 307  
Basic observational techniques in astronomy. Stellar photometry and spectroscopy.

## 410 Senior Thesis

Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 5 credits in all enrollments for this course. P:M: (AST 301) and completion of Tier I writing requirement.  
Design and execute an original experiment or computation. A written and oral report of the research is required.

## 800 Research Methods

Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. RB: AST 801  
Apprenticeship in astrophysical research. Student will work closely with faculty member to learn research techniques.

## 802 Techniques of Modern Astrophysics

Fall, Spring. 3 credits. RB: AST 801  
Students are introduced to modern astrophysics through participation in short projects involving literature surveys, professional planning, and research in observational, theoretical, and computational astrophysics.

## 805 Research Project

Fall, Spring. 3(0-3) A student may earn a maximum of 6 credits in all enrollments for this course.  
Research project to be completed under the guidance of an astronomy faculty member.

## 810 Radiation Astrophysics

Fall of odd years. 3(3-0)  
Transfer of radiation through plasmas and processes for emission and absorption of photons. Interpretation of the spectra of stars, the interstellar medium, and galaxies.

## 820 Advanced Topics in Astrophysics

Fall, Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. RB: AST 801  
Advanced work in a specialized astrophysical topic.

## 825 Galactic Astronomy

Spring of odd years. 3(3-0)  
The Milky Way as a galaxy. Observations and techniques of theoretical analysis that are used to discover the features of our galaxy.

## 835 Extragalactic Astronomy

Fall of even years. 3(3-0)  
Galaxies beyond the Milky Way. Large-scale structure of the universe. Cosmology.

## 840 Stellar Astrophysics

Spring of even years. 3(3-0)  
Physics of stellar interiors. Methods for calculating stellar models. Principles of stellar evolution.

## 850 Electrodynamics of Plasmas

Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering and Physics. Administered by Electrical and Computer Engineering. RB: ECE 835 or PHY 488 SA: EE 850

Plasma kinetic and macroscopic plasma transport theory. Electromagnetic wave propagation and charged particle diffusion processes in plasma. Electromagnetic energy absorption via elastic and inelastic collisions. Dc, rf, and microwave discharges.

## 860 Gravitational Astrophysics

Fall. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. RB: PHY 820 and PHY 841  
Experimental foundations, theory, and applications of gravitational physics and general relativity. Tests of the equivalence principle, modern solar system tests of general relativity, Schwarzschild metric, Hawking effect, Einstein's field equations.

## 861 Cosmology

Spring. 3(3-0) R: Open only to graduate students in the Department of Physics and Astronomy. SA: AST 860A  
Current research in cosmology: observational basis for the Big Bang, the cosmic background radiation, primordial nucleosynthesis, content and distribution of matter, cosmic geometry, growth of perturbations.

## 899 Master's Thesis Research

Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to graduate students in the Astronomy and Astrophysics major.  
MS Thesis Research

## 911 Numerical Techniques in Astronomy

Spring of odd years. 2(2-0) P:M: PHY 810 and PHY 820 or approval of department  
Numerical solutions to key problems in astronomy and astrophysics. N-body gravitational calculations, hydrodynamics in astronomy, radiative transfer, and techniques for large datasets.

## 912 Observational Astronomy

Spring of even years. 2(2-0) P:M: PHY 820 or approval of department R: Open to graduate students in the Astrophysics and Astronomy major.  
Fundamentals of observational astronomy. Aspects of telescope and instrument design, astronomical observations at visible and near-infrared wavelengths, X-ray observations, and data analysis techniques.

## 999 Doctoral Dissertation Research

Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 120 credits in all enrollments for this course. R: Open only to doctoral students in the Astronomy and Astrophysics major.  
Doctoral dissertation research.