

# ASTR - ASTRONOMY

## ASTR 600 Order-of-Magnitude Astrophysics

**Credit 1. 1 Lecture Hour.** Introduction to the utility of order of magnitude calculations and the ability to think intuitively; short overviews of basic physical concepts followed by interactive activities and problem solving at the board. May be repeated for credit. **Prerequisite:** ASTR 314 or equivalent, or approval of instructor.

## ASTR 601/PHYS 641 Extragalactic Astronomy

**Credits 3. 3 Lecture Hours.** Overview of observations of galaxies and large-scale structures in the Universe to understand their formation and evolution from theoretical and observational perspectives; galaxy luminosity functions; evolution of stellar populations and chemical enrichment; clusters and AGN. **Prerequisites:** PHYS 601; or ASTR 314 and PHYS 302; or approval of instructor. **Cross Listing:** PHYS 641/ASTR 601.

## ASTR 602/PHYS 642 Astronomical Observing Techniques and Instrumentation

**Credits 3. 3 Lecture Hours.** Theory and practice of obtaining and analyzing astrometric, photometric, spectroscopic, and interferometric measurements of astronomical sources across the electromagnetic spectrum; principles of design, fabrication, assembly, test, deployment, and use of astronomical instruments. **Prerequisites:** PHYS 615 or equivalent; or approval of instructor. **Cross Listing:** PHYS 642/ASTR 602.

## ASTR 603/PHYS 643 Stellar Astrophysics

**Credits 3. 3 Lecture Hours.** Theoretical and observational aspects of stellar astrophysics; thermodynamic properties of stellar interiors; energy sources; nuclear processes and burning stages; convective and radiative energy transport; evolutionary models; atmospheres; stability and pulsations; chemical enrichment processes; population synthesis. **Prerequisites:** PHYS 606 and PHYS 607 or equivalents; or approval of instructor. **Cross Listing:** PHYS 643/ASTR 603.

## ASTR 604/PHYS 644 Cosmology

**Credits 3. 3 Lecture Hours.** Basic principles of modern cosmology and particle physics; general relativity; cosmic inflation; Big Bang nucleosynthesis; expansion of the universe; cosmic microwave background; large-scale structure of the Universe; properties of particles; dark matter; dark energy. **Prerequisites:** PHYS 615 or equivalent; or approval of instructor. **Cross Listing:** PHYS 644/ASTR 604.

## ASTR 605/PHYS 645 Galactic Astronomy

**Credits 3. 3 Lecture Hours.** Basic nature and structure of constituents of Milky Way galaxy; distribution and motions of stars and gas; origin evolution and distribution of large-scale chemical abundances and kinematic patterns across populations; models of galaxy formation and implications of modern observations. **Prerequisites:** PHYS 601 and PHYS 607 or equivalents; or approval of instructor. **Cross Listing:** PHYS 645/ASTR 605.

## ASTR 606/PHYS 646 Radiative Transfer

**Credits 3. 3 Lecture Hours.** Fundamental radiative processes in stellar and planetary atmospheres; radiative fields; Stokes parameters; Mueller matrix formalism; radiation from moving charges; Compton scattering; plasma effects; atomic structure and radiative transitions; molecular structure and spectra; multiple scattering. **Prerequisites:** PHYS 302, PHYS 304, PHYS 408, and PHYS 412 or equivalents; or approval of instructor. **Cross Listing:** PHYS 646/ASTR 606.

## ASTR 681 Seminar

**Credit 1. 1 Lecture Hour.** Subjects of current importance; normally required of all graduate students in astronomy. May be repeated for credit.

## ASTR 684 Professional Internship

**Credits 1 to 4. 1 to 4 Other Hours.** An experience in an astronomy-related setting that provides the student with the opportunity for engaged learning through professional involvement and professional supervision; may be taken for credit up to four hours; must be taken on a satisfactory/unsatisfactory basis. **Prerequisites:** Approval of instructor; graduate classification.

## ASTR 685 Directed Studies

**Credits 1 to 9. 1 to 9 Other Hours.** Individual problems not related to thesis. **Prerequisite:** Approval of instructor.

## ASTR 689 Special Topics in...

**Credits 1 to 4. 1 to 4 Lecture Hours.** Selected topics in an identified area of astronomy. May be repeated for credit. **Prerequisite:** Approval of instructor.

## ASTR 691 Research

**Credits 1 to 23. 1 to 23 Other Hours.** Research toward thesis or dissertation. **Prerequisite:** Baccalaureate degree in physics or equivalent.