

# Course Catalog - Spring 2006

## Astronomy

### 100 **Perspectives in Astronomy** Credit: 3 hours.

One-term introduction to astronomy. The nature of science; sun, planets, and moons; origin of the solar system; nature and evolution of stars; exploding stars; stellar remnants, including white dwarfs, neutron stars, and black holes; molecules in space; galaxies and quasars; past and future of the universe; and life in the universe. Lectures and observation; a field trip to Parkland Staerkel Planetarium may be required, nominal charge. Credit is not given to students with credit in ASTR 121 or ASTR 122; not open to students with credit in PHYS 102, or equivalent. Students with credit in PHYS 102 are encouraged to take ASTR 121 or ASTR 122.

*This course satisfies the General Education Criteria for a Physical Sciences course.*

### 113 **The Sky** Credit: 3 hours.

Examines the visual aspects and phenomena of the sky; astronomical lore and history. Prerequisite: ASTR 100, ASTR 121 or ASTR 122, or consent of instructor

*This course satisfies the General Education Criteria for a Physical Sciences course.*

### 121 **The Solar System** Credit: 3 hours.

Introductory survey of the universe; structure and motions of the earth and moon; planetary motions; physical nature of the planets; comets and meteors; origin and evolution of the solar system. Emphasis will be placed on problem-solving and scientific methods. Two lectures and one discussion each week, and observing sessions during the term. Intended for non-science majors; science and Astronomy majors should take ASTR 210. Credit not given to students with credit in ASTR 100 or ASTR 210 or GEOL 116; or in PHYS 212 or higher-level Physics course. Students with credit in PHYS 211 are encouraged to take ASTR 210. Prerequisite: Credit or concurrent enrollment in a Quantitative Reasoning I course.

*This course satisfies the General Education Criteria for a Physical Sciences, and Quant Reasoning II course.*

### 122 **Stars and Galaxies** Credit: 3 hours.

Introduction to astrophysical objects and phenomena beyond the solar system, and the governing basic physical principles; galaxies, quasars, and structure of the universe; cosmology; the Milky Way; the interstellar medium and the birth of stars; distances, motions, radiation, structure, evolution, and death of stars, including neutron stars and black holes. Emphasis will be placed on problem-solving and scientific methods. Two lectures and one discussion each week, and observing sessions during the term. Intended for non-science majors; science and Astronomy majors should take ASTR 210. Credit not given to students with credit in ASTR 100 or ASTR 210, or in PHYS 212 or higher-level physics course. Students with credit in PHYS 211 are encouraged to take ASTR 210. Prerequisite: Credit or concurrent enrollment in a Quantitative Reasoning I course.

*This course satisfies the General Education Criteria for a Physical Sciences, and Quant Reasoning II course.*

### 131 **The Solar System Lab** Credit: 1 hours.

Laboratory studies which complement the lecture course, ASTR 121, The Solar System. Includes a visit to Staerkel Planetarium, observations with telescopes on campus, and computer labs. Using telescopes and their eyes, students will observe constellations, the Sun, the Moon and Planets. A robotic camera called Stardial will be used to track the motion of asteroids. Computer exercises simulate observations of the Sun, Jupiter, and Mercury. Prerequisite: Credit in ASTR 100 or ASTR 121, or concurrent registration in ASTR 121.

### 132 **Stars and Galaxies Lab** Credit: 1 hours.

Laboratory studies which complement the lecture course, ASTR 122, Stars and Galaxies. Includes a visit to Staerkel Planetarium, observations with telescopes on campus, and computer labs. Using telescopes and their eyes, students will observe constellations, the Moon and planets, star clusters, nebulae and galaxies. A robotic camera called Stardial will be used to study variable stars and nebulae. Computer exercises simulate observations of stars, star clusters and galaxies. Prerequisite: Credit in ASTR 100 or ASTR 122, or concurrent registration in ASTR 122.

### 199 **Undergraduate Open Seminar** Credit: 1 to 5 hours.

May be repeated. Approved for both letter and S/U grading.

**210 General Astronomy** Credit: 3 hours.

Survey of modern astronomy for students with background in physics. Topics include: the solar system; nature and evolution of stars; white dwarfs, neutron stars, and black holes; galaxies, quasars and dark matter; large scale structure of the universe; the Big Bang; and Inflation. Emphasis will be on the physical principles underlying the astronomical phenomena. Credit is not given to students who have credit in ASTR 100 or in ASTR 121 and ASTR 122. Prerequisite: Credit or concurrent registration in PHYS 212.

*This course satisfies the General Education Criteria for aPhysical Sciences course.*

**230 Extraterrestrial Life** Credit: 3 hours.

Scientific discussion of the search for extraterrestrial life. Topics include: cosmic evolution (protons to heavy elements to molecules); terrestrial evolution (chemical, biological, and cultural); high technology searches for extraterrestrial life in the solar system (Mars, Venus, outer planets); and beyond the solar system (Drake equation and current SETI projects). Prerequisite: ASTR 100, ASTR 121, ASTR 122, or ASTR 210; or consent of instructor.

*This course satisfies the General Education Criteria for aPhysical Sciences course.*

**350 Introduction to Cosmology** Credit: 3 hours.

Descriptive course on modern cosmological theories. Topics include aspects of special and general relativity; curved spacetime; the Big Bang; inflation; primordial element synthesis; the cosmic microwave background; the formation of galaxies and large scale structure. Prerequisite: ASTR 100, or ASTR 121, or ASTR 122, or ASTR 210, or consent of instructor.

*This course satisfies the General Education Criteria for aPhysical Sciences course.*

**390 Individual Study** Credit: 1 to 4 hours.

Individual study at an advanced undergraduate level. Prerequisite: Consent of advisor and of staff member who supervises the work.

**401 Scientific Writing for Astro** Credit: 1 hours.

Development of journal-style writing skills. Papers written in accordance with the Astrophysical Journal Manual of Style on topics approved by the instructor. Emphasis on developing adequate and critical coverage of the topic, brevity compatible with clarity, and effective presentation. Proper referencing, footnotes, and bibliography are covered. 1 undergraduate hour. Prerequisite: Concurrent enrollment in a designated 400-level astronomy course.

*This course satisfies the General Education Criteria for aAdvanced Composition course.*

**404 Stellar Astrophysics** Credit: 3 hours.

Introduction to astrophysical problems, with emphasis on underlying physical principles; includes the nature of stars, equations of state, stellar energy generation, stellar structure and evolution, astrophysical neutrinos, binary stars, white dwarfs, neutron stars and pulsars, and novae and supernovae. 3 undergraduate hours. Graduate students in Astronomy will not receive credit in ASTR 404. Prerequisite: PHYS 213 or PHYS 214; or consent of instructor.

**405 Solar System and IS Medium** Credit: 3 hours.

Physical processes in the solar system; dynamics of the solar system; physics of planetary atmospheres; individual planets; comets, asteroids, and other constituents of the solar system; extra-solar planets; formation of the solar system, stars, and planets; components of the interstellar medium; ionization and recombination; heating and cooling processes; comparison of theory with observations; composition and characteristics of interstellar dust; dynamics of the interstellar medium; interactions of stars with the interstellar medium: H II regions, planetary nebulae, and supernova remnants. Graduate students in astronomy will not receive credit in ASTR 405.

Prerequisite: PHYS 213 or PHYS 214.

**406 Galaxies and the Universe** Credit: 3 hours.

Nature of the Milky Way galaxy: stellar statistics and distributions, stellar populations, spiral structure, the nucleus and halo. Nature of ordinary galaxies; those in our Local Group, structure of voids and superclusters. Nature of peculiar objects: Seyfert galaxies, starburst galaxies, and quasars. Elementary aspects of physical cosmology. Prerequisite: ASTR 100 or ASTR 121 and ASTR 122 or ASTR 210; and PHYS 211 and PHYS 212

**414 Astronomical Techniques** Credit: 4 hours.

Introduction to techniques used in modern optical and radio astronomy with emphasis on the physical and mathematical understanding of the detection of electromagnetic radiation; includes such topics as fundamental

properties of radio and optical telescopes and the detectors that are used with telescopes. Lectures and laboratory. 4 undergraduate hours. Graduate students in Astronomy will not receive credit for ASTR 414. Prerequisite: MATH 242; PHYS 213 or PHYS 214; or consent of instructor. ASTR 210 is recommended.

**450 Astrochemistry** Credit: 4 hours.  
Same as CHEM 450. See CHEM 450.

**452 Introduction to Geophysics** Credit: 4 hours.  
Same as GEOL 452. See GEOL 452.

**496 Seminar in Astronomy** Credit: 1 to 4 hours.  
Lectures on topics of current interest in astronomy and astrophysics; for advanced undergraduates and graduates. See Class Schedule for current topics. May be repeated. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

**502 Theory Diffuse Matter Dynamics** Credit: 4 hours.  
Astrophysical magnetohydrodynamics (MHD) is developed and applied to the interstellar medium; formation, equilibrium and collapse of interstellar clouds; star formation; shock waves and ionization fronts; dynamics of stellar systems and spiral structure; Newtonian cosmology and galaxy formation in the early universe; cosmic electrodynamics. Prerequisite: PHYS 436, PHYS 427, and PHYS 486; or consent of instructor.

**503 Observational Astronomy** Credit: 4 hours.  
Techniques and basic results of observational astronomy; gamma ray, x-ray, ultraviolet, visible, infrared, and radio astronomy; photometry, imaging, spectroscopy, and polarimetry; gravitational waves; cosmic rays; neutrinos; positional astronomy; noise; statistics; data analysis; optics. Prerequisite: Consent of instructor.

**504 Theoretical Stellar Physics** Credit: 4 hours.  
Application of physical principles to energy generation and flow in astrophysical environments: equations of state; thermonuclear reactions; radiative transport; convection; stellar spectra; nebular spectra; evolution of both single and binary stars; compact stars; accretion disks; thermal and particle history of the universe. Same as PHYS 542. Prerequisite: PHYS 436, PHYS 427, and PHYS 486; or consent of instructor.

**515 General Relativity I** Credit: 4 hours.  
Same as PHYS 515. See PHYS 515.

**516 General Relativity II** Credit: 4 hours.  
Same as PHYS 516. See PHYS 516.

**541 Physics of Compact Objects** Credit: 4 hours.  
Same as PHYS 541. See PHYS 541.

**590 Individual Study** Credit: 2 to 8 hours.  
Individual study or nonthesis research. May be repeated to a maximum of 16 hours. Prerequisite: Consent of adviser and of staff member who supervises the work.

**596 Seminar in Special Topics** Credit: 0 to 16 hours.  
May be repeated. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

**599 Thesis Research** Credit: 0 to 16 hours.  
Approved for S/U grading only.