

Course Catalog - Spring 2009

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 Staerke Planetarium may be required, nominal charge. Intended for non-science majors; students with credit in PHYS 102 are encouraged to take ASTR 121 and/or ASTR 122. Credit is not given to students with credit in ASTR 121, ASTR 122, ASTR 210, PHYS 212, or equivalent.

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. Not intended for physical science majors; students with credit in PHYS 211 are encouraged to take ASTR 210. Credit is not given to students with credit in ASTR 100, ASTR 210, GEOL 116, or PHYS 212.

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. Not intended for physical science majors; students with credit in PHYS 211 are encouraged to take ASTR 210. Credit is not given to students with credit in ASTR 100, ASTR 210, or PHYS 212.

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

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. Prerequisite: Credit or concurrent registration in PHYS 212.

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

330 **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).

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. Credit is not given to students with credit in ASTR 406. Prerequisite: ASTR 100, or ASTR 121, or ASTR 122, or ASTR 210, or consent of instructor.

This course satisfies the General Education Criteria for a Physical 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 a Advanced 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 212; or consent of instructor.

Recommended: ASTR 210, PHYS 213, PHYS 214.

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 212; or consent of instructor. Recommended: ASTR 210, PHYS 213, 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; galaxies in our Local Group, structure of voids and superclusters. Nature of peculiar objects: Seyfert galaxies, starburst galaxies, and quasars. Elementary aspects of physical cosmology. Graduate students in Astronomy will not receive credit for ASTR 406. Prerequisite: PHYS 212; or consent of instructor. Recommended: ASTR 210, PHYS 213, PHYS 214.

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 241 or equivalent; PHYS 212; or consent of instructor. Recommended: ASTR 210, PHYS 213, PHYS 214.

450 ***Astrochemistry*** credit: 4 hours.

Same as CHEM 450. See CHEM 450.

451 ***Astrochemistry Laboratory*** credit: 3 or 4 hours.

Same as CHEM 451. See CHEM 451.

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

540 **Astrophysics** credit: 4 hours.

Same as PHYS 540. See PHYS 540.

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.

Approved for both letter and S/U grading. May be repeated. Prerequisite: Consent of instructor.

599 **Thesis Research** credit: 0 to 16 hours.

Approved for S/U grading only.