

ASTRONOMY AND ASTROPHYSICS

(AS) {ASTR}

001. A Survey of the Universe. (C) Physical World Sector. All classes. Only one ASTR course below ASTR 011 may be taken for credit. Engineering students receive no credit for this course.

A general survey, designed for the non-major, of the facts and theories of the astronomical universe, from solar system, to stars, to galaxies and cosmology. Topics include planets, satellites, small objects in the solar system, and extraterrestrial life; stars, their evolution, and their final state as white dwarfs, neutron stars, or black holes; galaxies, quasars, large structures, background radiation, and big bang cosmology. Elementary algebra and geometry will be used. This course is not recommended for physical-science majors or engineering students.

003. The Solar System. (C) Physical World Sector. All classes. Only one ASTR course below ASTR 011 may be taken for credit.

A survey course on the Solar System designed for the non-major. The emphasis will be on understanding the origin and history of our Solar System and planetary systems around other stars using the latest observational results. Elementary algebra and geometry will be used. Physical science majors and engineering students should prefer ASTR 011 to this course.

005. Galaxies and the Universe. (C) Physical World Sector. All classes. Only one ASTR course below ASTR 011 may be taken for credit.

A survey course on understanding stars, galaxies, and the history of the Universe. Subjects include the Sun, supernovae, black holes, the Milky Way, dark matter and dark energy, and the Big Bang. All discussions will emphasize how our knowledge of distant, exotic objects is based on physical theories such as Relativity, and tested with observations and discoveries that continue to the present day. Elementary algebra and geometry will be used. Physical-science majors and engineers should prefer ASTR 012 to this course.

006. Life in the Universe. (C) Natural Science & Mathematics Sector. Class of 2010 and beyond. Also fulfills General Requirement in Physical World for Class of 2009 and prior. Only one ASTR course below ASTR 011 may be taken for credit.

An examination of the origin and evolution of life in the Universe. This class is intended for non-majors and has no specific required science or math preparation beyond high school levels. Course material includes aspects of biology, geology, astronomy, physics, and chemistry as well as the study of and search for life in our Solar System (Mars, Europa) and elsewhere in the Universe. The origin of life on Earth and the range of extreme conditions in which life on Earth exists today will also be studied. Students will be asked to synthesize course material from lectures, readings, laboratory exercises, and homeworks to form an understanding of origin of life on Earth and the prospects for life elsewhere.

007. The Big Bang and Beyond. (C) Natural Science & Mathematics Sector. Class of 2010 and beyond. Also fulfills General Requirement in Physical World for Class of 2009 and prior. Only one ASTR course below ASTR 011 may be taken for credit.

An introductory course for freshmen who do not intend to major in a physical science or engineering, covering theories of the Universe ranging from the ancient perspective to the contemporary hot big bang model, including some notions of Einstein's special and general theories of relativity. Topics will include the solar system, stars, black holes, galaxies, and the structure, origin and future of the Universe itself. Elementary algebra is used. Fulfills quantitative data analysis requirement.

011. Introduction to Astrophysics I. (A) Physical World Sector. All classes. Prerequisite(s): MATH 104, PHYS 150, or concurrently.

A basic course for majors in astronomy, in other physical sciences, and in engineering. Fundamental knowledge of the solar system, its formation, stellar structure and evolution including black holes.

012. Introduction to Astrophysics II. (B) Physical World Sector. All classes. Prerequisite(s): MATH 114, PHYS 151, or concurrently.

A basic course for majors in astronomy, in other physical sciences, and in engineering. Stars, galaxies, and the evolution of the universe.

L/L 150. Observational Astronomy. (M) May be counted as a General Requirement Course in Physical World. Class of 2009 & prior only. An observing-based astronomy course for non-science majors; no prerequisites. Maximum number: 25.

Requires substantial out-of-class time dedication and commitment to sharing work in small groups. Topics: how to read star-maps and find objects in the night sky, learning about astronomical phenomena as we observe them, telescope training, signal processing. 1.5 hour daytime lecture each week plus 3-hour evening lab in smaller groups.

250. Astronomical Techniques. (M) Prerequisite(s): ASTR 001, or ASTR 007, or ASTR 011, or ASTR 012. For science majors. If a student has only taken ASTR 001, MATH 240-241 will also be required. The observatories at DRL are used for experimental and observational practice.

Topics: spherical astronomy, timekeeping/coordinate systems, astrostatistics, telescopes, CCD's, signal processing. Requires substantial out-of-class time dedication and commitment to sharing work in small groups. Two 1.5 hour evening lectures per week plus additional evening observations. Maximum number: 15

503. Astronomical Methods and Instrumentation. (M)

Techniques of modern astronomical observations, including: detection; systems of light from the radio through gamma rays; sources of noise in astronomical measurements; image analysis and reduction techniques; telescope optics and adaptive optics; spectroscopic measurements; radio interferometry and spectroscopy.

525. (PHYS503) General Relativity and Cosmology. (M)

This is a graduate level, introductory course in general relativity and modern cosmology. The basics of general relativity will be covered with a view to understanding cosmology and carrying out calculations relevant to the expanding universe and perturbations in it. Some of the key topics in modern cosmology will be covered -- these include the cosmic microwave background, large-scale structure, gravitational lensing and dark energy. The current cosmological model and open questions driving research will be discussed briefly in connection with these topics.

533. Galaxies: Structure, Dynamics and Formation. (H)

Galactic structure and dynamics. Observed scaling relations. Models and observations of galaxy formation and evolution. Enrollment restricted to graduate students.