

# ASTROPHYSICS (ASTR)

## Courses

### ASTR 161 THE SKY AND THE SOLAR SYSTEM (4)

A course for non-science majors covering observational astronomy, telescopes, Earth as a planet, the Moon, Solar System, Sun, general properties of stars. Development of enough algebra - based physics to understand these topics at a non-technical level. Three lecture hours and one two-hour laboratory period. Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

### ASTR 181 STARS, GALAXIES, AND THE EARLY UNIVERSE (4)

A course for non-science majors covering stellar evolution, galaxies, cosmology, and possibly other topics including life elsewhere in the universe. Emphasizes determination of the distance scale and modern trends in astronomy. Development of enough algebra-based physics to understand these topics at a non-technical level. Three lecture hours and one two-hour laboratory period. Students who have successfully completed ASTR 162 will not receive additional credit for ASTR 181. Prerequisite: high school algebra suggested. Core: Biological & Physical Sciences. Lab/class fee will be assessed.

### ASTR 261 INTRODUCTION TO ASTROPHYSICS (4)

Students will develop an understanding of the physical processes governing motions of celestial objects; the electromagnetic spectrum and the interaction of light and matter; star and planet formation and evolution; the extragalactic distance scale; and the early universe. Core: Biological and Physical Sciences. Prerequisites: PHYS 211 or PHYS 241 (may be taken concurrently); not open to students who have successfully completed ASTR 161 and ASTR 181. Lab/Class fee will be assessed.

### ASTR 295 RESEARCH PROBLEMS IN ASTROPHYSICS (1-4)

Individual project in any branch of astrophysics. Repeatable for a maximum of 6 units. Prerequisite: freshman or sophomore standing and permission of the faculty member who will mentor the research project.

### ASTR 301 COSMIC ORIGINS (3)

Origin and evolution of the universe, stars, and planets; the rise of life on Earth; social, technological and ethical issues raised by the scientific search for extraterrestrial life and its possible discovery on other worlds. Prerequisite: one Core 7 or Core 8 science course. Core: Ethical Issues & Perspectives.

### ASTR 303 ASTROPHYSICAL TECHNIQUES (3)

Observational astronomy using the department's telescope and NASA archival data, emphasizing equipment operating principles, scientific methods, signal statistics, data reduction. Includes imaging and photometry with charge-coupled devices in addition to spectroscopy, space observations, radio astronomy. Corequisite: PHYS 212 or PHYS 242. Prerequisites: ASTR 161 and ASTR 181 or ASTR 261. Lab/Class fee will be assessed.

### ASTR 331 STELLAR ASTROPHYSICS (3)

Applications of physics in astronomy, spectroscopy, stellar interiors and evolution, the interstellar medium. Prerequisites: ASTR 261 or both ASTR 161 and ASTR 181; PHYS 242 or PHYS 252 (may be taken concurrently); PHYS 243 is recommended.

### ASTR 371 PLANETARY ASTRONOMY (3)

Planetary formation both around our Sun and around other stars, planetary interiors and surface processes, and atmospheres. Primitive surfaces, cratering, volcanism, tectonism, origin and evolution of planetary atmospheres. The course may include an observational segment (e.g., sketching the planets through a telescope) and field trips to local sites of geological interest. Prerequisites: ASTR 161 or ASTR 261 or GEOL 121 and PHYS 211 (or PHYS 241).

### ASTR 385 ASTROPHYSICS SEMINAR (1)

Students learn to present technical material orally by attending and discussing presentations given by others and by giving presentations themselves on topics of current interest in astrophysics. Prerequisite: junior/senior standing as a Physics Major or Astronomy Minor.

### ASTR 395 RESEARCH PROBLEMS IN ASTROPHYSICS (1-4)

Individual project in any branch of astrophysics. Repeatable for a maximum of 9 units. Prerequisites: junior standing and permission of the faculty member who will mentor the research project.

### ASTR 432 GALAXIES AND COSMOLOGY (3)

Stellar populations and the general properties of galaxies, including the Milky Way; galaxy formation and evolution; active galaxies; dark matter and dark energy; current topics in the study of the early universe; special and general relativity. Prerequisites: ASTR 181 or ASTR 261; PHYS 243; PHYS 311 (may be taken concurrently).

### ASTR 452 HIGH ENERGY ASTROPHYSICS (3)

An in-depth introduction to the physics of high energy phenomena in the universe, including emission from black holes, neutron stars, white dwarfs, supernova explosions/supernova remnants, active galactic nuclei and galaxy clusters. Introduction to high energy emission from these phenomena, including synchrotron radiation, Bremsstrahlung radiation and inverse Compton scattering. Prerequisites: PHYS 243 and PHYS 307 (required); ASTR 181 or ASTR 261 and PHYS 311 (recommended).

### ASTR 470 SELECTED TOPICS IN CONTEMPORARY ASTROPHYSICS (3)

Special topics in the area of astrophysics. Special topics will be determined by current interests of the faculty and the needs of the curriculum. Special permission from the department is required. Prerequisites: ASTR 161 & ASTR 162.

### ASTR 490 INDEPENDENT STUDY IN ASTROPHYSICS (1-4)

May be repeated for a maximum of 6 units. Prerequisite: junior standing and consent of the instructor.

### ASTR 491 DIRECTED READINGS IN ASTROPHYSICS (1-4)

May be repeated for a maximum of 6 units. Prerequisites: junior status and consent of the instructor.

### ASTR 495 RESEARCH PROBLEMS IN ASTROPHYSICS (1-4)

Individual project in any branch of astrophysics. May be repeated for a maximum of 9 units. Prerequisites: senior status and permission of faculty member who will mentor the research project.

### **ASTR 497 CAPSTONE RESEARCH IN ASTROPHYSICS (1-4)**

Individual project in any branch of astrophysics. At the completion of a project, students must write a formal research paper on the work done. May be repeated for a maximum of 6 units. Prerequisites: junior status and permission of the faculty member who will mentor the research project.

### **ASTR 499 HONORS THESIS IN ASTROPHYSICS (1-4)**

Writing of an honors thesis based on independent research done under the direction of a faculty member. May be repeated for a maximum of 6 units. Prerequisites: senior major status and permission of the faculty member who will mentor the research project.