

# Astronomy

In the College of Sciences

**OFFICE: Physics/Astronomy 210**  
**TELEPHONE: (619) 594-6182**  
**FAX: (619) 594-1413**  
**EMAIL: astro@mintaka.sdsu.edu**  
**WEB SITE: mintaka.sdsu.edu**

## Faculty

Emeritus: Daub, May, Nelson, Talbert, Young, A.  
Chair: Etzel  
Professors: Angione, Etzel (Director of Mt. Laguna Observatory),  
Shafter  
Assistant Professors: Orosz, Sandquist, Welsh  
Adjunct: Hood, Miller, Ringwald, Teare, Tovmassian, Veal, Wood,  
Young, A.T.

## Offered by the Department

Master of Science degree in astronomy.  
Major in astronomy with the B.A. degree in liberal arts and sciences.  
Major in astronomy with the B.S. degree in applied arts and sciences.  
Minor in astronomy.

## The Major

Will the universe expand forever? Is there life on other planets? How are stars formed? These are the types of questions being addressed by students majoring in astronomy. Some areas of study in astronomy include the sun, the solar system, the stars, the Milky Way, the galaxies, and cosmology.

SDSU is the only institution in The California State University system that offers a complete academic program in astronomy. Students actively participate in all phases of observational astronomical research.

Joint faculty and student research activities are principally in the area of observational astrophysics. These include ongoing investigations of cosmology, eclipsing binary stars, low mass stars, planetary nebulae, galactic clusters, exterior galaxies, and atmospheric physics.

Much of this work is done at the Mount Laguna Observatory operated by the University. Modern astronomical detectors are employed that produce digital data, which lend themselves to computer analysis. Faculty and students also participate in space astrophysics projects. The department has excellent computer facilities at the observatory and on-campus.

Graduates with a bachelor's degree are trained in the application of the scientific method to the realm of astronomy and astrophysics, which requires a good foundation of understanding of physics and mathematics. Additionally, our students obtain useful skills in computing applications and in the use of modern electronic instrumentation. Many of our graduates find employment in industry, with astronomical observatories, or with government agencies or government contractors. These jobs support continuing research and include telescope operators, instrument makers, opticians, electronic technicians, programmers, photographers, and laboratory technicians. Some of our graduates pursue advanced degrees.

Employment opportunities for astronomers who have advanced degrees include positions in colleges and universities, in national observatories and government laboratories, in planetariums, and in industry and private companies.

## Astronomy Major

### With the B.A. Degree in Liberal Arts and Sciences (Major Code: 19111)

All candidates for a degree in liberal arts and sciences must complete the graduation requirements listed in the section of this catalog on "Graduation Requirements." No more than 48 units in astronomy courses can apply to the degree.

A minor is not required with this major.

**Preparation for the Major.** Astronomy 101; Mathematics 150, 151, and 252; Physics 195, 195L, 196, 196L, 197, 197L. (28 units)  
Recommended: Chemistry 200, Computer Science 106 or 107.

**Foreign Language Requirement.** Competency (equivalent to that which is normally attained through three consecutive semesters of college study) is required in one foreign language as part of the preparation for the major. Refer to the section of this catalog on "Graduation Requirements."

**Upper Division Writing Requirement.** Passing the University Writing Examination or completing one of the approved writing courses with a grade of C (2.0) or better.

**Major\*.** A minimum of 27 upper division units in astronomy and physics to include Astronomy 340, 350, 440, 450; Mathematics 342A; Physics 350, 354; and six units selected with the approval of the astronomy undergraduate adviser. Recommended: Astronomy 320; Physics 360, 400A, 406.

## Astronomy Major

### With the B.S. Degree in Applied Arts and Sciences (Major Code: 19111)

All candidates for a degree in applied arts and sciences must complete the graduation requirements listed in the section of this catalog on "Graduation Requirements."

**Preparation for the Major.** Astronomy 101; Mathematics 150, 151, 252; Physics 195, 195L, 196, 196L, 197, 197L. (28 units)

Recommended: Chemistry 200, Engineering 120 or Computer Science 106 or 107.

**Upper Division Writing Requirement.** Passing the University Writing Examination or completing one of the approved writing courses with a grade of C (2.0) or better.

**Major\*.** A minimum of 36 upper division units in astronomy and physics to include Astronomy 340, 350, 440, 450, 498A, 498B; Physics 350, 354, 360, 400A; and nine units selected from Astronomy 320; Physics 311, 400B, 406, 410.

**Minor in Mathematics.** All candidates for the B.S. degree in astronomy must complete a minor in mathematics, to include Mathematics 342A, 342B, and three additional upper division units of electives in mathematics. Recommended: Mathematics 541; Statistics 551A.

## Astronomy Minor\*

The minor in astronomy consists of a minimum of 15 units to include Astronomy 101 and 12 upper division units selected from Astronomy 301, 310, 320+, 340+, 350+, 440+, 450+.

Courses in the minor may not be counted toward the major, but may be used to satisfy preparation for the major and general education requirements, if applicable. A minimum of six upper division units must be completed in residence at San Diego State University.

\* Mathematics 342A-342B may be substituted for Physics 340A-340B as prerequisite for physics courses, where appropriate.

+ Additional prerequisites required.

## COURSES (ASTR)

### LOWER DIVISION COURSES

#### 101. Principles of Astronomy (3) I, II

Discover the universe: planets, stars, galaxies, and our place in the cosmos; the Big Bang; how stars shine; comets, meteors, nebulae, the Milky Way; black holes and other exotic objects.

#### 109. Astronomy Laboratory (1) I, II

Three hours of laboratory.

Prerequisite: Credit or concurrent registration in Astronomy 101.

Demonstration of astronomical principles through observations with astronomical instruments and analysis of astronomical data. A nighttime field trip to Mount Laguna Observatory is required.

#### 296. Experimental Topics (1-4)

Selected topics. May be repeated with new content. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.

### UPPER DIVISION COURSES (Intended for Undergraduates)

#### 301. Cosmology and Gravitational Collapse (3)

Prerequisite: Completion of the General Education requirement in Foundations II. A.1. Physical Sciences.

Einstein's theory of general relativity applied to problems of gravitational collapse (stellar evolution, neutron stars, black holes) and cosmology (origin and evolution of the universe).

#### 310. Astrobiology and the Search for Extraterrestrial Life (3) I, II

Prerequisites: Completion of the General Education requirement in Foundations II.A.1. Physical Sciences or II.A.2. Life Sciences.

Extraterrestrial life in our solar system and other planetary systems; formation of stars and planets; UFOs and SETI; origin and evolution of life on earth; life in extreme environments; cosmology and structure of universe.

#### 320. Solar System Astronomy (3)

Prerequisites: Astronomy 101 and Physics 197, 197L.

Structures of the planets, their atmospheres and satellite systems, asteroids, comets, and meteoroids, and the interplanetary medium, including the sun's influence in the system.

#### 340. Spherical Astronomy (3) I

Prerequisites: Credit or concurrent registration in Mathematics 252 and Physics 197.

Problems in spherical astronomy, astronomical coordinate systems, time, general precession, and introduction to celestial mechanics.

#### 350. Astronomical Techniques (3) II

Prerequisite: Astronomy 340.

Data acquisition and data reduction for current instrumentation including photoelectric photometry, direct imaging, and spectroscopy. Techniques for obtaining precise measurements.

#### 440. Astrophysics of Stars (3) I

Prerequisites: Credit or concurrent registration in Mathematics 342A and Physics 354.

Radiative transfer theory, atmospheres of stars and the emergent spectrum, interior structure and evolution of stars, stellar pulsations.

#### 450. Astrophysics of Star Systems (3) II

Prerequisites: Credit or concurrent registration in Mathematics 342A and Physics 354.

Applications of physics in study of binary stars, star clusters, the interstellar medium and galactic structure, galaxies, and cosmology.

#### 496. Experimental Topics (3)

Selected topics. May be repeated once with new content. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.



#### 498A. Senior Project (1) I, II

Prerequisite: An acceptable master plan for graduation within one year.

Selection and design of individual projects.

#### 498B. Senior Project (2) I, II

Six hours of laboratory.

Prerequisite: Astronomy 498A.

Individual research project culminating in a final written report.

#### 499. Special Study (1-3) I, II

Prerequisite: Consent of instructor.

Individual study. Maximum credit six units.

### UPPER DIVISION COURSE (Also Acceptable for Advanced Degrees)

#### 596. Advanced Topics in Astronomy (2 or 3) I, II

Prerequisite: Consent of instructor.

Selected topics in theoretical astronomy or astrophysics. May be repeated with new content upon approval of instructor. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree. Maximum credit of six units of 596 applicable to a bachelor's degree. Maximum combined credit of six units of 596 and 696 applicable to a 30-unit master's degree.

### GRADUATE COURSES Refer to Bulletin of the Graduate Division.