

Astronomy

IN THE COLLEGE OF SCIENCES

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Faculty

Emeritus: Angione, Daub, Etzel, Leach, May, Shafter, Talbert
Chair: Sandquist
Professors: Orosz, Sandquist, Welsh
Associate Professors: Leonard, Quimby
Assistant Professor: Rubin
Lecturer: Rao Sudhakar
Adjunct: Blanco

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 learn to collect astronomical observations and conduct scientific research.

Joint faculty and student research activities are principally in the area of observational astrophysics. These include ongoing investigations of cosmology, eclipsing binary stars, the formation of galaxies, extrasolar planets, low-mass stars, and star clusters.

The department operates Mount Laguna Observatory, which is frequently used to train students in the use of astronomical telescopes and instruments. Faculty and students also participate in space astrophysics research.

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 instrumentation. Many of our graduates find employment in education, industry, with astronomical observatories, or with government agencies or contractors. Jobs that support continuing research include electronic technicians, image analysts, instrument makers, laboratory technicians, opticians, software developers, and telescope operators. Some of our graduates pursue advanced degrees.

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

Impacted Program

The astronomy major is an impacted program. To be admitted to the astronomy major, students must meet the following criteria:

- Complete preparation for the major;
- Complete a minimum of 60 transferable semester units;
- Have a minimum cumulative GPA of 2.0.

To complete the major, students must fulfill the degree requirements for the major described in the catalog in effect at the time they are accepted into the premajor at SDSU (assuming continuous enrollment).

Major Academic Plans (MAPs)

Visit <http://www.sdsu.edu/mymap> for the recommended courses needed to fulfill your major requirements. The MAPs website was created to help students navigate the course requirements for their majors and to identify which General Education course will also fulfill a major preparation course requirement.

Astronomy Major

With the B.A. Degree in Liberal Arts and Sciences

(Major Code: 19111) (SIMS Code: 770501)

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 201; Mathematics 150, 151, 252; Physics 195, 195L, 196, 196L, 197, 197L. (27 units)

Recommended: Chemistry 200, Computer Science 107.

Language Requirement. Competency (equivalent to that which is normally attained through three consecutive semesters of college study) is required in one foreign language to fulfill the graduation requirement. Refer to the section of this catalog on "Graduation Requirements."

Graduation Writing Assessment Requirement. Passing the Writing Placement Assessment with a score of 10 or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

Major. A minimum of 27 upper division units in astronomy and physics to include Astronomy 350, 440, 450; Mathematics 342A; Physics 350, 354; and nine units selected with the approval of the astronomy undergraduate adviser. Recommended: Physics 360, 400A, 406, 410.

Astronomy Major

With the B.S. Degree in Applied Arts and Sciences

(Major Code: 19111) (SIMS Code: 770502)

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 201; Mathematics 150, 151, 252; Physics 195, 195L, 196, 196L, 197, 197L. (27 units)

Recommended: Chemistry 200, Computer Science 107.

Graduation Writing Assessment Requirement. Passing the Writing Placement Assessment with a score of 10 or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

Major. A minimum of 36 upper division units in astronomy and physics to include Astronomy 350, 440, 450, 498A, 498B; Physics 350, 354, 360, 400A; and 12 units selected from Astronomy 320, 510; Physics 311, 317, 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 340; Statistics 551A.

Astronomy Minor

(SIMS Code: 770501)

The minor in astronomy consists of a minimum of 15 units to include Astronomy 201 and 12 upper division units selected from Astronomy 303, 310, 320+, 350+, 440+, 450+, 510+, or 496 subject to approval of the minor adviser.

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.

+Additional prerequisites required.

Courses (ASTR)

Refer to *Courses and Curricula and University Policies sections of this catalog for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.*

LOWER DIVISION COURSES

ASTR 101. Principles of Astronomy (3) [GE]

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. Not open to students with credit in Astronomy 201.

ASTR 109. Astronomy Laboratory (1) [GE]

Three hours of laboratory.

Prerequisite: Credit or concurrent registration in Astronomy 101 or 201.

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

ASTR 201. Astronomy for Science Majors (3) [GE]

Prerequisite: Satisfaction of the SDSU Mathematics/Quantitative Reasoning Assessment requirement.

Directed toward students with a strong interest in science and mathematics. Understanding the night sky, introduction to the solar system, star formation and evolution, extrasolar planets, nature of the Milky Way and other galaxies, origin and fate of the universe. Students with credit in Astronomy 101 and 201 will receive a total of three units of credit toward graduation.

ASTR 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)

ASTR 303. A Walk Through the Stellar Graveyard (3) [GE]

Prerequisites: Completion of the General Education requirement in Foundations of Learning II.A.1. Physical Sciences and in Foundations of Learning II.A.4. Mathematics/Quantitative Reasoning.

Deaths of stars and their exotic corpses to include black holes, neutron stars, and white dwarfs. User-friendly introduction to Einstein's relativity theories, gravitational waves, and warped space-time.

ASTR 310. Astrobiology and the Search for Extraterrestrial Life (3) [GE]

Prerequisite: Completion of the General Education requirement in Foundations of Learning 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.

ASTR 320. Solar System Astronomy (3)

Prerequisites: Astronomy 201 and Physics 197, 197L.

Structures of the planets; their surfaces, atmospheres, and satellite systems; asteroids, comets, and meteoroids. The Sun, its structure, energy production, and influence in the solar system. Life in the solar system.

ASTR 350. Astronomical Techniques (3)

Prerequisites: Astronomy 201, Mathematics 342A, and Physics 197.

Astronomical observation and optics. Data acquisition and reduction for modern astronomical instrumentation including photometry, direct imaging, and spectroscopy. Techniques for obtaining precise measurements and determining measurement uncertainties.

ASTR 440. Astrophysics of Stars (3)

Prerequisites: Physics 354. Recommended: Physics 360.

Lives, interior structures, and physics that determines how stars work. Stellar atmospheres and spectrum of light that emerges from stars.

ASTR 450. Astrophysics of Star Systems (3)

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

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

ASTR 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.

ASTR 498A. Senior Project (1)

Prerequisite: A student's academic program must demonstrate that they are on track to graduate within one academic year.

Selection and design of individual projects.

ASTR 498B. Senior Project (2)

Six hours of laboratory.

Prerequisite: Astronomy 498A.

Individual research project culminating in a final written report.

ASTR 499. Special Study (1-3)

Prerequisite: Consent of instructor.

Individual study. Maximum credit six units.

UPPER DIVISION COURSES

(Also Acceptable for Advanced Degrees)

ASTR 510. Exoplanets (3)

Prerequisites: Astronomy 350 and 440, or Physics 350 and 354 with minimum grade of B-, and consent of instructor.

Extrasolar planet detection; mass and radius determination; transits and eclipses; orbital dynamics and transit timing variations; internal and atmospheric characteristics; the exoplanet population and formation scenarios.

ASTR 596. Advanced Topics in Astronomy (2-3)

Prerequisite: Consent of instructor.

Selected topics in 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. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

GRADUATE COURSES

Refer to the *Graduate Bulletin*.