

# Astronomy

IN THE COLLEGE OF SCIENCES

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## Faculty

**Eric L. Sandquist**, Ph.D., Professor of Astronomy,  
Chair of Department

**Jerome A. Orosz**, Ph.D., Professor of Astronomy (Graduate Adviser)

**William F. Welsh**, Ph.D., Professor of Astronomy

**Douglas C. Leonard**, Ph.D., Associate Professor of Astronomy

**Robert Quimby**, Ph.D., Associate Professor of Astronomy

**Kate Rubin**, Ph.D., Assistant Professor of Astronomy

## Associateships

Graduate teaching associateships in astronomy are available to a few qualified students. A limited number of graduate research assistantships are also available from the department or through faculty with funded research projects. Application for teaching associate or graduate research positions is done as part of the student's application for Admission to Graduate Study.

## General Information

The Department of Astronomy offers graduate study leading to the Master of Science degree in astronomy. The degree is designed to prepare students either for further graduate work leading to the doctorate, or for a professional career in teaching or in industry.

San Diego State University operates the Mount Laguna Observatory, which is located 45 miles east of the campus at an elevation of 6,100 feet. The observatory houses three research telescopes: the new 1.25-m Phillips Claud reflector, a 1.0-m telescope, and an "Evryscope" that images the entire sky repeatedly throughout the night. Each of these is available for faculty and student research. Instrumentation for these telescopes includes both optical and near-IR cameras, as well as optical spectrographs. A dormitory is available to house visiting astronomers and there is also a shop-laboratory building on site. The observatory also houses the 0.5-m Buller telescope, which is featured in our education and public outreach programs connected to the neighboring Awona Harrington Visitor Center.

Campus facilities include a fixed 12-inch reflecting telescope, ten portable 8-inch Meade LX200 reflectors, and 20 smaller assorted portable reflecting telescopes. Two CCD cameras are also available. A Spitz AP3 planetarium is used for both student instruction and public outreach programs. The central campus library has a very extensive collection of astronomical texts and journals. In addition, the Special Collections section contains the world-renowned Zinner Collection of rare and historically important astronomical texts. The department also maintains a resource room of astronomical catalogs, charts, and selected reference texts.

Some of the research interests in the department include the structure and evolution of stars, eclipsing and interacting binary stars, the stellar content of nearby galaxies (through observations of novae and low-mass x-ray binaries), exoplanets, the formation of galaxies, gas flows, and supernovae. Graduate students are extensively involved in many of these research programs. Students often make use of observatory facilities in support of their thesis research.

## Admission to Graduate Study

All students must satisfy the general requirements for admission to the university with classified graduate standing, as described in Admission and Registration. In addition, students must have an overall grade point average of at least 2.85 in the last 60 units of their undergraduate work and must have preparation in astronomy and/or related sciences substantially equivalent to that required for the bachelor's degree in astronomy at San Diego State University.

Students applying for admission should electronically submit the university application available at <http://www.calstate.edu/apply> along with the application fee.

All applicants must submit admissions materials separately to SDSU Graduate Admissions and to the Department of Astronomy.

### Graduate Admissions

The following materials should be submitted as a complete package directly to:

#### Graduate Admissions

Enrollment Services  
San Diego State University  
San Diego, CA 92182-7416

1. Official transcripts (in sealed envelopes) from all postsecondary institutions attended;
  - Students who attended SDSU need only submit transcripts for work completed since last attendance.
  - Students with international coursework must submit both the official transcript and proof of degree. If documents are in a language other than English, they must be accompanied by a certified English translation.
2. GRE scores (<http://www.ets.org> SDSU institution code 4682);
3. English language score, if medium of instruction was in a language other than English (<http://www.ets.org> SDSU institution code 4682).

### Department of Astronomy

The following materials should be mailed or delivered to:

**Department of Astronomy**  
(Attention: Graduate Adviser)  
San Diego State University  
5500 Campanile Drive  
San Diego, CA 92182-1221

1. Letters of reference (two or three);
2. Personal statement;
3. Application for teaching associate position or graduate assistantship (if desired).

## Advancement to Candidacy

All students must satisfy the general requirements for advancement to candidacy as specified in Requirements for Master's Degrees. If the student's undergraduate preparation is deficient, he/she will be required to take courses for the removal of the deficiency. These courses are in addition to the minimum of 30 units for the master's degree.

## Specific Requirements for the Master of Science Degree

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

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Requirements for Master's Degrees, the student must also meet the following departmental requirements in a 30-unit program:

1. Complete the 12-unit core course curriculum (Astronomy 630, 650, 660, 680).
2. Complete at least 15 additional units of 500-, 600-, 700-level in astronomy graduate level courses or approved 500-level courses in astronomy or related fields as approved by departmental graduate adviser; not to exceed 12 units of 500-level courses if pursuing Plan B.
3. Plan A: Astronomy 799A, Thesis (3) Cr/NC/RP, and pass a final oral examination on the thesis. The Plan A option requires the consent of the astronomy graduate adviser.  
**OR**  
 Plan B: Pass a final comprehensive examination covering the astronomy core curriculum and complete three additional units of graduate level or approved 500-level courses in astronomy or related fields with approval of department graduate adviser.
4. Facility with a scientific computing language is required.

## Courses Acceptable for Master's Degree Program in Astronomy (ASTR)

Refer to *Courses and Curricula and Regulations of the Division of Graduate Affairs* sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

### UPPER DIVISION COURSES

#### 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

#### ASTR 610. Binary Stars (3)

Prerequisite: Astronomy 450.

Visual, spectroscopic, and eclipsing binary stars. Review of observational techniques. Methods of orbital analysis with applications emphasizing determination of fundamental stellar properties, such as mass, radius, temperature, and luminosity. Implications for stellar evolution.

#### ASTR 620. Galactic Structure (3)

Prerequisite: Astronomy 450.

Survey of basic observational data for determining structure of Milky Way Galaxy. Includes luminosity functions, stellar distributions, solar motion, stellar populations, kinematics and dynamics of general and peculiar stellar motions.

#### ASTR 630. Stellar Atmospheres and Interiors (3)

Prerequisites: Astronomy 440 and Mathematics 342A.

Gas thermodynamics and equations of state. Production of stellar continuum radiation and spectral lines. Theories of radiative and convective energy transport. Interior structure and evolution of stars.

#### ASTR 650. Galactic Structure and Evolution (3)

Prerequisite: Astronomy 680.

Stellar and gaseous structures of the Milky Way and external galaxies. Properties to include chemical evolution, color distributions, luminosity functions, mass-to-light ratios, scaling relations, and surface brightness profiles. Dark matter halos, gravitational collapse models, and hierarchical structure formation. Contents and physical state of interstellar and circumgalactic media.

#### ASTR 660. Galaxies and Cosmology (3)

Prerequisite: Astronomy 450.

Morphology, photometric, and spectroscopic properties, dynamics, and evolution of normal galaxies. Current interpretations of peculiar galaxies and QSO's. The extragalactic distance scale. Observational cosmology.

#### ASTR 670. Foundations of Modern Cosmology (3)

Prerequisite: Astronomy 680.

Big Bang nucleosynthesis, cosmic microwave background, early universe, expansion dynamics, extragalactic distance scale, large-scale structure, Newtonian and relativistic cosmology. Observational constraints on cosmological parameters and equation of state.

#### ASTR 680. Astronomical Techniques (3)

Prerequisites: Astronomy 350 and 450.

Basic methods of data acquisition and analysis. Emphasis is given to CCD direct imaging, spectroscopy, and photometry. Direct experience with telescopes and instruments at Mount Laguna Observatory, as well as with the department computing and image processing facility.

#### ASTR 797. Research (1-3) Cr/NC/RP

Prerequisite: Classified graduate standing.

Research in one of the fields of astronomy. Maximum credit six units applicable to a master's degree.

#### ASTR 798. Special Study (1-3) Cr/NC/RP

Prerequisite: Consent of staff; to be arranged with department chair and instructor.

Individual study. Maximum credit six units applicable to a master's degree.

#### ASTR 799A. Thesis (3) Cr/NC/RP

Prerequisites: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.

#### ASTR 799B. Thesis Extension (0) Cr/NC

Prerequisite: Prior registration in Thesis 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis is granted final approval.