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ACADEMIC PROGRAMS

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# ASTRONOMY

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- Department Office**  
Schultz Information Center, 2nd floor  
(707) 664-2119  
www.phys-astro.sonoma.edu
- Department Chair**  
Lynn R. Cominsky Gayle Walker
- Faculty**  
Lynn R. Cominsky, \*John R. Dunning Jr.  
Bryant P. Hichwa, Enrique W. Izaguirre, Reza Khosravani,  
Saeid Rahimi, Gordon G. Spear, \*Joseph S. Tenn  
*\*Faculty Early Retirement Program*
- Minor Requirements / Individual Class Descriptions
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Minor in Astronomy
- Astronomy, offered as a minor in the Department of Physics and Astronomy, is the study of the planets, stars and galaxies in the universe beyond the earth's atmosphere. The fields of Astronomy and Astrophysics, the application of physics principles to astronomical observations, today deal with basic and important questions, such as the origin and nature of the "Big Bang" which created space and time, the subsequent creation of matter and the chemical elements, the eventual formation and evolution of structure in the universe, and the life cycles of stars, including the tremendous explosions which are often their death knells and can lead to the formation of black holes. Modern astronomy leans heavily on the concepts and techniques of physics and mathematics. Astronomers use ground and space-based instruments that detect photons spanning the electromagnetic spectrum, as well as particles such as cosmic rays or neutrinos. An emerging branch of astronomy seeks to detect the gravitational radiation predicted by Einstein's Theory of General Relativity.
- As a result of astronomy's cosmic scope and dependence on physics, degrees in astronomy are generally granted at the graduate level. The minor in astronomy, with a B.S. in physics, is an excellent preparation for graduate study in astronomy or astrophysics.
- Career fields for which an astronomy minor would be beneficial include aerospace, astronomy, atmospheric science, education, planetary geology, and geophysics.
- A variety of courses are available within the minor, including intermediate and advanced laboratory work that utilizes the department's two observatories, and a number of descriptive courses for students whose major interests lie in other fields.
- The SSU Campus Observatory, in operation since 1976, houses two telescopes, a 14-inch Schmidt-Cassegrain and a 10-inch Newtonian, with auxiliary instrumentation for CCD imaging, and spectroscopy. Both telescopes are computer controlled. The observatory is used by students in laboratory and lecture courses, and is also available for faculty and student research projects. A new NASA-funded research observatory is located in the darker skies of northern Sonoma County. It includes a remotely-controlled and operated 14-inch telescope mounted on a computer controlled Paramount and equipped with a high quantum efficiency CCD detector and filter wheel. Equipment available for observational work in astronomy at SSU is ideally suited for studying objects that vary in time and space. This includes objects that vary in brightness such as pulsating, eclipsing, and explosively cataclysmic star systems. This also includes the variable nuclei of active galaxies such as quasars and blazars, Gamma-ray Bursts (GRBs), and extrasolar planetary systems that exhibit planetary transits. Our equipment is also ideally suited for follow-up observations of Near Earth Objects (NEOs) which may threaten the Earth. All students are invited to participate in

the ongoing research programs of the department, or to propose student-initiated research programs.

## Minor in Astronomy

Completion of a minimum of 20 units in astronomy and other physical science courses, at least 12 of which must be in astronomy, constitutes a minor in astronomy. Interested students should consult with an advisor in the Department of Physics and Astronomy.

## Astronomy Courses (ASTR)

Classes are offered in the semesters indicated. Please see the Schedule of Classes for most current information and faculty teaching assignments.

### **100 Descriptive Astronomy (3) Fall, Spring**

Lecture, 3 hours. Historic astronomy, Newton's Laws, gravitation, atomic structure, light, and telescopes. The solar system, space flight, stars and stellar evolution, interstellar matter, star clusters, galaxies, the universe. A survey designed primarily for non-science majors. Satisfies GE, category B1 or B3.

### **231 Introductory Observational Astronomy (2) Fall**

Lecture, 1 hour; laboratory, 3 hours. Principles of astronomical measurement techniques with field and laboratory studies of astronomical objects. Identification of constellations, astronomical coordinates, use of the telescope, techniques in imaging, photometry, and spectroscopy. Satisfies GE, category B1 or B3, and GE laboratory requirements. Prerequisite: previous or concurrent enrollment in ASTR 100.

### **303 Extraterrestrial Intelligence and Interstellar Travel (3) Fall**

Lecture, 3 hours. A largely descriptive survey. Theories of the origin of life; conditions for extraterrestrial intelligence; problems of communication; space flight and interstellar travel. Satisfies GE, category B3. Prerequisite: ASTR 100.

### **305 Frontiers in Astronomy (3) Fall**

Lecture, 3 hours. A survey of recent developments in astronomy: exploration of the solar system; attempts to detect neutrinos from the sun; interstellar molecules, pulsars, quasars, x-ray and ultraviolet astronomy; new trends in cosmological thinking. Satisfies GE, category B3. Prerequisite: one course in astronomy.

### **331 Astronomical Imaging (2) Spring**

Lecture, 1 hour; laboratory, 3 hours. An introduction to the methods and techniques of astronomical imaging using digital images. The course will offer a practical approach to using charge-coupled device (CCD) detectors. Experience will be gained using the CCD camera at the SSU Observatory to obtain images of the moon, planets, stars, and nebulae. Topics to be covered include use of astronomical telescopes, planning observing programs, identifying astronomical objects, determining exposure times and image sizes, and CCD calibration techniques. Image processing techniques will be illustrated using several different image processing software packages. Prerequisite: ASTR 231 or consent of instructor.

### **350 Cosmology (3) Spring**

Lecture, 3 hours. A largely descriptive survey. Theories of the universe, as advocated by the Greeks, Newton, Einstein, Lemaître, Gamow, and Hoyle. Cosmological implications of black holes, quasars, and other recent discoveries. Satisfies GE, category B3. Prerequisite: ASTR 100.

### **380 Astrophysics: Stars (3) Spring**

Lecture, 3 hours. A quantitative study of the structure and evolution of stars, including stellar interiors and atmospheres, nucleosynthesis and late stages of stellar evolution. Prerequisites: PHYS 314 and MATH 211.

### **396 Selected Topics in Astronomy (1-3)**

Lecture, 1-3 hours. A course of lectures on a single topic or set of related topics not ordinarily covered in the astronomy curriculum. The course may be repeated for credit with a different topic. Prerequisite: consent of instructor.

**482 Advanced Observational Astronomy (2) / Spring**

Lecture, 1 hour; laboratory, 3 hours. An introduction to astronomical spectroscopy, photometry and astrometry with emphasis on techniques at the telescope, and data reduction. Observing program preparation, use of telescopes with auxiliary instrumentation, photographic and photoelectric techniques. Statistical treatment of data and the method of least squares.

Prerequisites: ASTR 231, PHYS 209B and 210B, and MATH 161; or consent of instructor.

**492 Instructional Design Project (2) Fall, Spring**

A directed project to develop at least one laboratory experiment and/or classroom activity that teaches basic concepts in undergraduate astronomy. Both written and oral presentations (including a demonstration of the experiment or activity) will be required.

Prerequisite: PHYS 214 and 216 or PHYS 210B and 209B; ASTR 231.

**495 Special Studies (1-4) / Fall, Spring**

The Department of Physics and Astronomy encourages independent study and considers it to be an educational undertaking. Students wishing to enroll for special studies are required to submit to their supervising faculty members proposals which outline their projects and exhibit specific plans for their successful completion.

**497 Undergraduate Research in Astronomy (2) / Fall, Spring**

Supervised research in an area of astronomy that is currently under investigation by one or more members of the physics and astronomy department's faculty. This course may be repeated for up to 6 units of credit. Prerequisites: junior standing and consent of instructor.

SONOMA STATE UNIVERSITY

(707) 664-2880 • 1801 East Cotati Ave • Rohnert Park, CA 94928  
www.sonoma.edu • campus map

THE CALIFORNIA STATE UNIVERSITY