

ASTRONOMY

Astronomy courses are offered primarily through the Physics department, with subject code PHYSICS on the Stanford Bulletin's ExploreCourses website.

Although Stanford University does not have a degree program in astronomy or astrophysics, teaching and research in various branches of these disciplines are ongoing activities in the departments of Applied Physics, Physics, SLAC National Accelerator Laboratory, and Hansen Experimental Physics Laboratory (HEPL).

For the convenience of students interested in astronomy, astrophysics, and cosmology, a course program for undergraduate and graduate study is listed in the "Astronomy Cognate Courses (p. 2)" section of this bulletin. The list includes introductory courses for the student who wishes to be informed about the fields of astronomy without the need for prerequisites beyond high school algebra and physics. Courses in astronomy numbered below 100 are designed to serve this group of students. Astronomy courses numbered 100-199 serve the student interested in an initial scientific study of astronomy. The courses numbered 200 and above are for graduate students and advanced undergraduates, subject to prior approval by the course instructor.

Undergraduate Programs in Astronomy

The University does not offer a separate undergraduate major in Astronomy. Students who intend to pursue graduate study in astronomy or space science are encouraged to major in physics, following the advanced sequence if possible, or in electrical engineering if the student has a strongly developed interest in radioscience. The course descriptions for these basic studies are listed under the appropriate department sections of this bulletin. Students desiring guidance in developing an astronomy-oriented course of study should contact the chair of the Astronomy Program Committee. The following courses are suitable for undergraduates and are recommended to students considering advanced study in astronomy or astrophysics:

| | | Units |
|---|--|--------------|
| PHYSICS 100 | Introduction to Observational Astrophysics | 4 |
| PHYSICS 160 | Introduction to Stellar and Galactic Astrophysics | 3 |
| PHYSICS 161 | Introduction to Cosmology and Extragalactic Astrophysics | 3 |
| Students planning study in astronomy beyond the B.S. are urged to take: | | |
| PHYSICS 262 | General Relativity | 3 |

The above-mentioned courses are required for physics majors who choose the curriculum with a concentration in astrophysics (see the "Physics (<http://exploreddegrees.stanford.edu/schoolofhumanitiesandsciences/physics/>)" section of this bulletin).

Stanford Student Observatory

The student observatory, located in the hills to the west of the campus, is equipped with a 24-inch and other small reflecting telescopes. It is used for instruction of the observation-oriented courses, PHYSICS 50 Astronomy Laboratory and Observational Astronomy and PHYSICS 100 Introduction to Observational Astrophysics.

The Department of Physics offers a minor in Physics with a concentration in Astronomy.

Minor in Physics with Concentration in Astronomy

Students wishing to pursue advanced work in astrophysical sciences should major in Physics (<http://exploreddegrees.stanford.edu/schoolofhumanitiesandsciences/physics/#bachelorstext>) and concentrate in astrophysics. However, students outside of Physics with a general interest in astronomy may organize their studies by completing one of the following Physics minor concentration programs.

Students who take the 20, 40, or 60 series at Stanford in support of their major may count those units towards the minor.

An undergraduate Physics minor with a concentration in Astronomy requires the following courses:

Non-Technical

For students whose majors do not require the PHYSICS 40 or 60 series:

| | | Units |
|------------------------------|--|--------------|
| PHYSICS 21 | Mechanics, Fluids, and Heat | 4 |
| PHYSICS 23 | Electricity, Magnetism, and Optics | 4 |
| PHYSICS 25 & PHYSICS 26 | Modern Physics and Modern Physics Laboratory | 5 |
| PHYSICS 50 or PHYSICS 100 | Astronomy Laboratory and Observational Astronomy Introduction to Observational Astrophysics | 3-4 |
| Select two of the following: | | 6 |
| PHYSICS 15 | Stars and Planets in a Habitable Universe | |
| PHYSICS 16 | The Origin and Development of the Cosmos | |
| PHYSICS 17 | Black Holes and Extreme Astrophysics | |

Technical

For students whose majors require the PHYSICS 40 or 60 series:

| | | Units |
|---------------------------------------|--|--------------|
| Select one of the following Series: | | 14-17 |
| Series A | | |
| PHYSICS 41 | Mechanics | |
| PHYSICS 43 | Electricity and Magnetism | |
| PHYSICS 45 & PHYSICS 46 | Light and Heat and Light and Heat Laboratory | |
| PHYSICS 70 | Foundations of Modern Physics | |
| Series B | | |
| PHYSICS 61 | Mechanics and Special Relativity | |
| PHYSICS 63 | Electricity, Magnetism, and Waves | |
| PHYSICS 65 | Quantum and Thermal Physics | |
| PHYSICS 67 | Introduction to Laboratory Physics | |
| And take the following three courses: | | |
| PHYSICS 100 | Introduction to Observational Astrophysics | 4 |
| PHYSICS 160 | Introduction to Stellar and Galactic Astrophysics | 3 |
| PHYSICS 161 | Introduction to Cosmology and Extragalactic Astrophysics | 3 |
| Total Units | | 24-27 |

Students are also encouraged to take the electricity and magnetism/optics lab of the appropriate PHYSICS series, PHYSICS 24, PHYSICS 44 or PHYSICS 64 for 1 additional unit.

Graduate Programs in Astronomy

Graduate programs in astronomy and astrophysics and related topics are carried out primarily in the Department of Physics but also the departments of Applied Physics and Electrical Engineering. Students should consult the course listings, degree requirements, and research programs of these departments for more detailed information.

Graduate research opportunities are available in many areas of theoretical and observational astronomy. For further information, see the Kavli Institute of Particle Astrophysics and Cosmology (<http://kipac.stanford.edu>) website.

| | Units |
|--|-------|
| Students planning to conduct research in astronomy and astrophysics should take: | |
| Select one of the following: | 3 |
| PHYSICS 361 Cosmology | |
| PHYSICS 362 Advanced Extragalactic Astrophysics and Cosmology (Not offered 2018-19) | |
| Students lacking a background in astrophysics, gravitation, and plasma physics should take: | |
| PHYSICS 260 Introduction to Stellar and Galactic Astrophysics | 3 |
| PHYSICS 261 Introduction to Cosmology and Extragalactic Astrophysics | 3 |
| PHYSICS 262 General Relativity | 3 |
| PHYSICS 312 Basic Plasma Physics (Not offered 2018-19) | 3 |
| Students with special interests in gravitation should take: | |
| PHYSICS 364 Advanced Gravitation (Not offered 2018-19) | 3 |

Each year a number of "special topics" course are offered. Refer to courses in the PHYSICS 360 range for more details. Students interested in research programs in space physics involving spacecraft studies of the planets, their satellites, and their near-space environments should see the "Center for Space Science and Astrophysics (<http://exploreddegrees.stanford.edu/centerslaboratoriesandinstitutes/#spacesciencetext>)" section of this bulletin.

Emeriti: (Professors) Peter A. Sturrock, G. Leonard Tyler, Robert V. Wagoner

Professors: Tom Abel (Physics, SLAC), Steve Allen (Physics, SLAC), Roger Blandford (Physics, SLAC), Pat Burchat (Physics), Blas Cabrera (Physics), Sarah Church (Physics), Kent Irwin (Physics, SLAC), Steven Kahn (Physics, SLAC), Bruce Macintosh (Physics), Peter Michelson (Physics), Vahé Petrosian (Physics, Applied Physics), Roger W. Romani (Physics)

Associate Professors: Chao-Lin Kuo (Physics, SLAC), Risa Wechsler (Physics, SLAC)

Professor (Research): Philip H. Scherrer (Physics)

Astronomy Cognate Courses

Elementary Lectures

The following courses provide a descriptive knowledge of astronomical objects and astrophysics. PHYSICS 15, PHYSICS 16, and PHYSICS 17 are for students not majoring in the sciences and are taught in different quarters by different instructors, and may be taken individually or in any order.

| | | Units |
|------------|---|-------|
| PHYSICS 15 | Stars and Planets in a Habitable Universe | 3 |
| PHYSICS 16 | The Origin and Development of the Cosmos | 3 |
| PHYSICS 17 | Black Holes and Extreme Astrophysics | 3 |

Observatory

The following courses allow students to use the on-campus Stanford Student Observatory, and are intended to familiarize students with observational methods and analysis of astronomical data. PHYSICS 50 is for general students, while PHYSICS 100 involves more advanced observations and is intended for students with a college level background in physics.

| | | Units |
|-------------|--|-------|
| PHYSICS 50 | Astronomy Laboratory and Observational Astronomy | 3 |
| PHYSICS 100 | Introduction to Observational Astrophysics | 4 |

Advanced Undergraduate

The following courses are for students with a more advanced knowledge of basic physics and mathematics, and form the core courses for a concentration in astrophysics for Physics majors.

| | | Units |
|-------------|--|-------|
| PHYSICS 160 | Introduction to Stellar and Galactic Astrophysics | 3 |
| PHYSICS 161 | Introduction to Cosmology and Extragalactic Astrophysics | 3 |

Graduate

| | | Units |
|-------------|---|-------|
| PHYSICS 260 | Introduction to Stellar and Galactic Astrophysics | 3 |
| PHYSICS 261 | Introduction to Cosmology and Extragalactic Astrophysics | 3 |
| PHYSICS 262 | General Relativity | 3 |
| PHYSICS 269 | Neutrinos in Astrophysics and Cosmology (Not offered 2018-19) | 3 |
| PHYSICS 301 | Astrophysics Laboratory (Not offered 2018-19) | 3 |
| PHYSICS 312 | Basic Plasma Physics (Not offered 2018-19) | 3 |
| PHYSICS 361 | Cosmology (Not offered 2018-19) | 3 |
| PHYSICS 362 | Advanced Extragalactic Astrophysics and Cosmology (Not offered 2018-19) | 3 |
| PHYSICS 366 | Special Topics in Astrophysics: Statistical Methods | 2 |
| PHYSICS 368 | Computational Cosmology and Astrophysics (Not Offered 2018-19) | 2 |