Department of Astronomy

Professor: *Bauer, French (Chair)*

Associate Professor: *McLeod*

Instructor in Astronomy Laboratory: *Slivan*

Astronomy is the study of the universe, from planets and stars to the Milky Way and distant galaxies, from the instant of the Big Bang to the current era of rapid expansion and beyond to the distant future. Modern astronomers rely on careful observations of the cosmos and on their understanding of physical laws to make sense of our often baffling but always fascinating universe. The astronomy curriculum emphasizes hands-on observations at the Whitin Observatory, using a fleet of small telescopes in introductory courses and the 24" research telescope for advanced classes and student research. The underlying physical principles of astronomy are elucidated at all levels, from introductory courses for non-science majors to upper level classes in advanced astrophysics.

The astronomy department offers two introductory survey courses geared to non-science majors: 100 and 101wL. These courses are taught at a similar level and both fulfill the mathematical modeling distribution requirement. Students who elect to take both may do so in either order. ASTR 108 is a seminar for first year students emphasizing hands-on astronomy. ASTR 109 and 206 fulfill the Quantitative Reasoning overlay course requirement.

ASTR 100 Life in the Universe
Bauer, McLeod
This course investigates the origin of life on the earth and the prospects for finding life elsewhere in the cosmos, and begins with an overview of the earth's place in the solar system and the universe. The course examines the early history of the earth and the development of life, changes in the sun that affect the earth, characteristics of the other objects in our solar system and their potential for supporting life, the detection of planets around stars other than the sun, and the search for extraterrestrial life. Some nighttime observing will be required. This course does not count toward a major in astrophysics.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement.
Distribution: Mathematical Modeling or Natural and Physical Science
Semester: Fall, Spring Unit: 1.0

ASTR 101wL Introduction to Stars, Galaxies, and Cosmology with Laboratory
French, Bauer
This course examines the life stories of stars, from birth in clouds of gas and dust, through placid middle age, to violent explosive demise, leaving white dwarfs, neutron stars, or black holes. It also explores the makeup and structure of galaxies, which contain billions of stars and are racing away from each other as part of the overall expansion of the universe. Finally, it presents modern cosmological models for the origin and ultimate fate of the universe. The course emphasizes the interaction of observations and the mathematical models developed from these data. Evening laboratory at the observatory.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Not open to students who have already taken 110.
Distribution: Mathematical Modeling or Natural and Physical Science
Semester: Fall, Spring Unit: 1.25

ASTR 108 Discovering Our Universe
McLeod
This course leads first-year students through hands-on exploration of the structure of the Universe and our place within it. We will measure the size, shape, and spin of the Earth by using simple home-made instruments to observe the sky. We will learn to use Wellesley's own telescopes to explore the arrangement and contents of our own Solar System. Finally, we will determine our place within the Milky Way Galaxy and the Universe using data obtained from the National Virtual Observatory. Some daytime and nighttime observing will be required outside of class. This course is open only to first-year students. No prior experience in astronomy is required, but algebra and trigonometry will be used. Students who take ASTR108 may not take ASTR109.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Restricted to first year students.
Distribution: Natural and Physical Science or Mathematical Modeling
Semester: Fall Unit: 1.0

ASTR 109 Our Place in Space and Time

NOT OFFERED IN 2008-09. This course traces the story of the quest to determine our place in space and time. Using hands-on experiments and key astronomical observations, we will measure the size and age of the earth, its distance from the sun and other stars, the location of our solar system within our galaxy, the distance to far-away galaxies, and the age and eventual fate of the expanding universe. The emphasis will be on applying quantitative reasoning skills to measure both what we know and how well we know it. Some nighttime observing will be required. This course does not count toward a major in astronomy or astrophysics. Recommended for students who have not taken ASTR 100, 101, or 110. Not open to students who have taken ASTR 108.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement.
Distribution: Natural and Physical Science or Mathematical Modeling. Fulfills the Quantitative Reasoning overlay course requirement.
Semester: N/O Unit: 1.0

ASTR 110wL Fundamentals of Astronomy with Laboratory

NOT OFFERED IN 2008-09. This course serves as an introduction to astronomy for students with a strong science background. The emphasis is on the physical principles that shape the universe and on the tools we exploit to learn about planets, stars, galaxies, and cosmology. Laboratory one evening per week offers hands-on access to the telescopes. Some assignments require daytime observing outside of class.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Not open to students who have already taken 101.
Distribution: Mathematical Modeling or Natural and Physical Science
Semester: N/O Unit: 1.25

ASTR 201 Motions in the Sky: Archaeoastronomy and the Copernican Revolution

NOT OFFERED IN 2008-09. OFFERED IN 2009-2010. This course examines the motions of the sun, moon, and planets in the sky and how humans have interpreted them through time. Archaeoastronomy is the study of astronomical knowledge in a culture as revealed through the archaeological record, written records, and ethnography. We will discuss the archaeoastronomy of several cultures, including the Mayans, native North Americans, and the Chinese. We will follow the beginnings of modern astronomy from the ancient Greeks through the Copernican revolution and Newton's formulation of the laws of motion. *Normally offered in alternate years.*

Prerequisite: Any 100-level astronomy course, and familiarity with trigonometric functions.
Distribution: Natural and Physical Science
Semester: N/O. Offered in 2009-10. Unit: 1.0

ASTR 203/GEOS 213 Planetary Geology
Bauer
Spacecraft observations have revealed a breathtaking diversity of geologic features in the solar system, from ancient river valleys on Mars and violent volcanic eruptions on Io to ice fountains on Enceladus and the complex surfaces of comets. From a comparative point of view, this course examines the formation and evolution of the planets and small bodies in the solar system. Topics will include: volcanism, tectonic activity, impacts, and tides. *Students may register for either ASTR 203 or GEOS 213 and credit will be granted accordingly. Normally offered in alternate years.*

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement and any 100-level ASTR or GEOS course.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.0

ASTR 205 Relativity and Cosmology
Bauer
Einstein's theories of space and time have brought about a fundamental change in our conceptual understanding of the universe. Using trigonometry and algebra, this course explores special and general relativity, space travel, black holes, gravitational lensing, galaxy evolution, dark matter, and the expanding universe. *Normally offered in alternate years.*

Prerequisite: 101, 108, or 110
Distribution: Mathematical Modeling or Natural and Physical Science
Semester: Spring Unit: 1.0

ASTR 206wL Basic Astronomical Techniques with Laboratory
McLeod
This course provides an introduction to modern methods of astronomical observation. Students will learn to use the Whitin Observatory 24-inch research telescope. Topics include: planning observations, modern instrumentation, and the acquisition and quantitative analysis of astronomical images. This course requires substantial nighttime telescope use and culminates with an independent observing project.

Prerequisite: 101, 108, or 110
Distribution: Mathematical Modeling or Natural and Physical Science. Fulfills the Quantitative Reasoning overlay course requirement.
Semester: Fall Unit: 1.25

ASTR 301 Seminar. Topics in Multiwavelength Astronomy
French
Topic for 2008-09: The Cassini Mission to Saturn. The newest generation of Earth- and space-based telescopes has allowed astronomers to survey the entire sky across the entire electromagnetic spectrum, from gamma rays to radio waves. The Cassini spacecraft, currently in orbit around Saturn, has revealed an astonishing and strange world of swirling storms, moons with ice geysers and ancient river beds, and complex and beautiful planetary rings. In this course, we will explore the Saturn system over a range of wavelengths, and carry out student projects using the latest observations from Cassini.

Prerequisite: 206
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.0

ASTR 311 Elements of Astrophysics

NOT OFFERED IN 2008-09. OFFERED IN 2009-10. Astrophysics is the application of physics to the study of the universe. We will use elements of mechanics, thermodynamics, electromagnetism, quantum mechanics, special relativity, and nuclear physics to investigate selected topics such as planets, the life stories of stars and galaxies, dark matter, and the origin of the universe. Our goals will be to develop insight into the physical underpinnings of the natural world, and to develop a 'universal toolkit' of practical astrophysical techniques that can be applied to the entire celestial menagerie. These tools include scaling analysis, numerical solutions to complex problems, and other research approaches advanced in professional literature. *Normally offered in alternate years.*

Prerequisite: PHYS 202 and 203
Distribution: Mathematical Modeling or Natural and Physical Science
Semester: N/O. Offered in 2009-2010. Unit: 1.0

ASTR 350 Research or Individual Study

Prerequisite: By permission of department.
Distribution: None

As of 5/1/2008

Semester: Fall, Spring Unit: 1.0

ASTR 360 Senior Thesis Research

Prerequisite: By permission of department. See Academic Distinctions.
Distribution: None
Semester: Fall, Spring Unit: 1.0

ASTR 370 Senior Thesis

Prerequisite: 360 and permission of department.
Distribution: None
Semester: Fall, Spring Unit: 1.0

Related Courses

For Credit Toward the Major

PHYS 216 Mathematics for the Sciences II

PHYS 202 Introduction to Quantum Mechanics and Thermodynamics with Laboratory

PHYS 203 Vibrations, Waves, and Special Relativity with Laboratory

Directions for Election

The Astronomy Major consists of ten courses. Required courses include ASTR 101, 108, or 110; ASTR 206; ASTR 301; PHYS 107; and either PHYS 106 or PHYS 108. The other five courses include one additional ASTR course at the 300-level; two in ASTR at the 200-level or above; one in MATH at the 200-level; and an additional course in ASTR or a related field. Students should consult with faculty about choosing electives and research opportunities appropriate for their fields of study. For example, students interested in earth science should elect ASTR 203 (Planetary Geology) and add courses in geosciences and chemistry. Students working towards teacher certification would add courses in other sciences and in Education, and might coordinate their fieldwork with ASTR 350, while those planning to enter the technical workforce might elect additional courses in computer science. Students planning to pursue graduate study in astronomy should instead elect an interdepartmental major in Astrophysics.

A minor in astronomy (five units) consists of: 101, 108, or 110; 301; and three additional units in astronomy.

Honors
To earn honors in the major, students must have a grade point average of at least 3.5 in all work in the major field above the 100-level; the department may petition on her behalf if her GPA in the major is between 3.0 and 3.5. The student must complete a significant research project culminating in a paper and an oral examination. The project must be conducted after the junior year and approved in advance by the department, and might be satisfied by a thesis, a summer internship, or a 350. See Academic Distinctions.

See description of Whitin Observatory and its equipment.

As of 5/1/2008