The Wesleyan Astronomy Department provides outstanding opportunities for undergraduates who wish to major in this fascinating subject, either in preparation for graduate school or as an end in itself. Our unique program blends coursework with research opportunity and provides students access to professional-quality telescopes, instrumentation, and computers. A principal strength is our active research faculty who will work one-on-one with undergraduates employing state-of-the-art instrumentation and computers to investigate areas of current astronomical interest.

Our students go on to graduate programs, including the best in the country, or to a variety of rewarding careers in and out of science. Many of our students are co-authors on research papers based on work performed during their undergraduate careers. In addition, we offer a comprehensive range of coursework that will prepare students for a variety of directions in life, including graduate study.

**FACULTY**

William Herbst  
BA, Princeton University; MAA, Wesleyan University; MSC, University of Toronto; PhD, University of Toronto  
John Monroe Van Vleck Professor of Astronomy; Professor of Astronomy; Professor, Integrative Sciences

Meredith Hughes  
BS, Yale University; PhD, Harvard University  
Assistant Professor of Astronomy; Assistant Professor, Integrative Sciences

Edward C. Moran  
BS, Pennsylvania State University; MA, Columbia University; MPHIL, Columbia University; PhD, Columbia University  
Professor of Astronomy; Director, Van Vleck Observatory; Professor, Integrative Sciences

Seth Redfield  
BM, New Eng Consv Music; BS, Tufts University; MS, University of Colorado Boulder; PhD, University of Colorado Boulder  
Associate Professor of Astronomy; Chair, Astronomy Department; Associate Professor, Integrative Sciences

**VISITING FACULTY**

Roy E. Kilgard  
BA, Valdosta St University; PhD, University of Leicester  
Support Astronomer and Research Associate Professor of Astronomy

**UNDERGRADUATE PROGRAM DEPARTMENTAL ADVISING EXPERTS**

William Herbst, Edward Moran, Seth Redfield

- Undergraduate Astronomy Major (catalog.wesleyan.edu/departments/astr/ugrd-astr)

**ASTRONOMY**

**ASTR103 The Planets**

More than 100 planets are now known in the universe, eight of which circle the sun. NASA missions and improved telescopes and techniques have greatly increased our knowledge of them and our understanding of their structure and evolution. In this course, we study those eight planets, beginning with the pivotal role that they played in the Copernican revolution, during which the true nature of the earth as a planet was first recognized. We will study the geology of the earth in some detail and apply this knowledge to our closest planetary neighbors—the moon, Venus, and Mars. This is followed by a discussion of the giant planets and their moons and rings. We will finish the discussion of the solar system with an examination of planetary building blocks—the meteorites, comets, and asteroids. Additional topics covered in the course include spacecraft exploration, extrasolar planetary systems, the formation of planets, life in the universe, and the search for extraterrestrial intelligence.

**Offering:** Crosslisting  
**Grading:** A-F  
**Credits:** 1.25  
Gen Ed Area: NSM-ASTR  
Identical With: E&ES151  
**Prereq:** None

**ASTR105 Exploring the Cosmos**

This introductory course for non-science majors unveils the universe and how we have come to understand our place in it. We will touch on a full range of astronomical topics, including the mechanics of our solar system, the discovery of planets around other stars, the stellar life cycle, the formation and evolution of galaxies, the big bang, and the ultimate fate of the universe. Occasional evening sessions will provide the opportunity to observe celestial objects through Wesleyan’s telescopes.

**Offering:** Host  
**Grading:** A-F  
**Credits:** 1.00  
Gen Ed Area: NSM-ASTR  
**Prereq:** None

**ASTR107 The Universe**

This course focuses on the modern scientific conception of the universe, including its composition, size, age, and evolution. We begin with the history of astronomy, tracing the development of thought that led ultimately to the big bang theory. This is followed by a closer look at the primary constituent of the universe—galaxies. We end with consideration of the origin and ultimate fate of the universe.

**Offering:** Host  
**Grading:** A-F  
**Credits:** 1.00  
Gen Ed Area: NSM-ASTR  
**Prereq:** None

**ASTR108 Conceptual Astronomy: Science Fact vs. Science Fiction**

Our conceptual understanding of the world around us is shaped by our experiences, often in subtle ways. In this media-dominated world, the public’s predominant exposure to science comes from science fiction in popular culture, especially TV and movies. In this course, we will examine the ways in which popular culture has influenced our collective knowledge about astronomy: the good, the bad, and the really bad. Wide-ranging topics will include asteroids and comets threatening the earth, travel through space and time, and life in the universe. Through lecture, discussion, and laboratory exercises, we will examine these topics through the lens of science to expose the reality of the universe that is our home.

**Offering:** Host  
**Grading:** A-F
and spectroscopy in a wide variety of applications. Data acquisition, image
processing, and data analysis methods will be discussed. In particular, students
will gain hands-on experience with the analysis of data obtained from both
ground- and satellite-based observatories. An introduction to the relevant
error analysis methods is included. Students will also become familiar with
the fundamental techniques that will be necessary when "big data" projects like
LSST come on line in the near future: database querying, metadata handling, and
modern programming techniques.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-ASTR
Identical With: ASTR522
Prereq: ASTR211

ASTR224 Exoplanets: Formation, Detection, and Characterization
Our ability to place the earth into a cosmic context dramatically improved in
the past decades with the discovery of planets around other stars (exoplanets).
The study of exoplanets has quickly become a dominant field in astronomy. This
course will focus on the fundamentals of exoplanet formation, detection, and
characterization (interiors and atmospheres) based on astronomical observables.
We will also discuss the assessment of habitability for Earth-like exoplanets and
the prospects for the detection of biosignatures.
Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-ASTR
Identical With: ASTR524
Prereq: (ASTR155 AND ASTR211)

ASTR231 Stellar Structure and Evolution
As the principal source of light in galaxies today and as drivers of chemical
evolution, stars play a critical role in the universe. It is important to understand
their structure and evolution. Fortunately, we have a fairly well-developed and -
tested theory of stellar structure covering both their interiors and atmospheres.
In this course, we will provide an introduction to that theory and examine its key
results, including a basic description of how stars evolve.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-ASTR
Identical With: ASTR531
Prereq: (PHYS213 AND PHYS214 AND ASTR155 AND ASTR211)
ASTR240 Radio Astronomy
This course will introduce students to the origins, theory, and practice of radio astronomy. It will cover theory of antennas and interferometers, as well as signal detection and measurement techniques. Particular emphasis will be placed on the theory and applications of Fourier transforms. A practical laboratory component will provide experience working with single-dish and interferometric data.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-ASTR
Prereq: ASTR155

ASTR401 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR402 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR407 Senior Tutorial (downgraded thesis)
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor. Only enrolled in through the Honors Coordinator.
Offering: Host
Grading: A-F

ASTR408 Senior Tutorial (downgraded thesis)
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor. Only enrolled in through the Honors Coordinator.
Offering: Host
Grading: A-F

ASTR409 Senior Thesis Tutorial
Topic to be arranged in consultation with tutor.
Offering: Host
Grading: OPT

ASTR410 Senior Thesis Tutorial
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR411 Group Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR412 Group Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR421 Undergraduate Research, Science
Individual research projects for undergraduate students supervised by faculty members.
Offering: Host
Grading: OPT

ASTR422 Undergraduate Research, Science
Individual research projects for undergraduate students supervised by faculty members.
Offering: Host
Grading: OPT

ASTR423 Advanced Research Seminar, Undergraduate
Advanced research tutorial; project to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR424 Advanced Research Seminar, Undergraduate
Advanced research tutorial; project to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR430 Seminar on Astronomical Pedagogy
Methods for effectively teaching astronomy at all levels from general public outreach to college level will be discussed.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: NSM-ASTR
Prereq: ASTR155 OR ASTR211

ASTR431 Research Discussion in Astronomy
Current research topics in astronomy will be presented and discussed by astronomy staff and students.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: NSM-ASTR
Prereq: ASTR155 OR ASTR211

ASTR491 Teaching Apprentice Tutorial
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member's course for academic credit.
Offering: Host
Grading: OPT

ASTR492 Teaching Apprentice Tutorial
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member's course for academic credit.
Offering: Host
Grading: OPT

ASTR500 Graduate Pedagogy
The elements of good teaching will be discussed and demonstrated through lectures, practice teaching sessions, and discussions of problems encountered in the actual teaching environment. The staff consists of faculty and experienced graduate students. An integral part of the course is a required one-day workshop before the first day of formal classes.

Training in pedagogy in the first semester of attendance is required for all incoming Wesleyan MA and PhD students who have not already fulfilled this requirement at Wesleyan. BA/MA students are not required to get training in pedagogy but may choose to do so.
Offering: Crosslisting
Grading: Cr/U
Credits: 0.50
Gen Ed Area: None
Identical With: E&ES500, CHEM500, BIOL500, MB&B500, MUSC500, PHYS500, PSYC500, MATH500
Prereq: None

ASTR501 Individual Tutorial for Graduates
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

ASTR502 Individual Tutorial for Graduates
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT
In this course, we will provide an introduction to that theory and examine its key results, including a basic description of how stars evolve.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-ASTR
Identical With: ASTR231
Prereq: (PHYS213 AND PHYS214 AND ASTR155 AND ASTR211)

ASTR532 Galaxies, Quasars, and Cosmology
This course introduces modern extragalactic astronomy, blending established practices in the field and important recent discoveries. Three major themes will be developed. First, the basics of Newtonian and relativistic cosmologies will be discussed, including modern determinations of the Hubble Law and the observations that have led to the currently favored cosmological model.

Next, the universe of galaxies will be investigated: their constituents, structure and kinematics, and multiwavelength properties. Finally, the nature of galactic nuclei will be explored, including the observational consequences of black-hole accretion and the coordinated growth of galaxies and their central black holes.

Outstanding research questions related to the topics covered will be highlighted throughout the course.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-ASTR
Identical With: ASTR232
Prereq: (ASTR155 AND ASTR211)

ASTR534 Advanced Research Seminar, Graduate
Advanced research tutorial; project to be arranged in consultation with the tutor.

Offering: Host
Grading: OPT

ASTR550 Advanced Research Seminar, Graduate
Advanced research tutorial; project to be arranged in consultation with the tutor.

Offering: Host
Grading: OPT

ASTR555 Planetary Science Seminar
This course will examine topics and methods in the interdisciplinary field of planetary science. Students will join several faculty members in the planetary science group to discuss the origin, evolution, and habitability of planets in this and other solar systems. This class is intended for graduate students who are pursuing or mean to pursue the planetary science concentration. Other graduate and undergraduate students may request admission to the course.

Offering: Crosslisting
Grading: Cr/U
Credits: 0.25
Gen Ed Area: NSM-ESS
Identical With: E&ES555
Prereq: None