ASTRONOMY

Overview and Contact Information
Modern astronomy is concerned with understanding the nature of the universe and the various structures—galaxies, stars, planets, atoms—within it. We are interested not only in describing these things, but in understanding how they are formed and how they change, and, ultimately, in reconstructing the history of the universe.

This understanding is always based upon the same set of theories and practices—physics, chemistry, biology, materials science, geology, mathematics, computer science—that we use to understand the earth and its immediate surroundings. Thus, all students are strongly encouraged to base their study of the universe upon a firm grounding in one of these disciplines.

All 100-level courses are taught by Mount Holyoke faculty and staff. Courses at the 200 level and above are staffed collectively by faculty in the Five College Department (as listed above); many of them will be offered off-campus. Students are urged to consult the department to assist in planning a program of study that takes advantage of the rich variety of course opportunities. Through advising, the exact program is always tailored to the student’s particular strengths, interests, and plans.

Astronomical facilities at all five institutions are available for student use. The Williston Observatory at Mount Holyoke includes a historic Clark 8” telescope. The McConnell Rooftop Observatory at Smith College includes two computer-controlled Schmidt Cassegrain telescopes, and the Amherst Observatory has a Clark 18” refractor.

Contact Information
Darby Dyar, Chair
Nicole Amrani, Academic Department Coordinator

206 Kendade Hall
413-538-2238
https://www.mtholyoke.edu/acad/astronomy

Mount Holyoke Faculty
This area of study is administered by the Astronomy department and is a collaborative program through the Five College Department of Astronomy (FCAD):
Darby Dyar, Kennedy-Schelkunoff Professor of Astronomy, Teaching Fall Only
Thomas Burbine, Visiting Lecturer in Astronomy
Jason Young, Visiting Lecturer in Astronomy

Five College Faculty
Calzetti, Edwards, Erickson, Follette, Giavalisco, Gutermuth, Hameed, Hannes, Heyer, Katz, Lowenthal, Mo, Narayanan, Pope, Schloerb, Schneider, Snell, Stage, Tripp (Five College chair), Wang, Ward-Duong, Weinberg, Whitaker, Wilson, Yun

Requirements for the Major
The astronomy major is designed to provide a good foundation in modern science with a focus on astronomy. Taken alone, it is suited for students who wish to apply scientific training in a broad general context. If coupled with additional course work in related fields, the astronomy major or minor provides the foundation to pursue a career as a professional astronomer or planetary scientist. Thus, advanced courses in geology, mathematics, physics, biology, and/or chemistry, as well as a facility in computer programming, are strongly encouraged.

Students should note that completion of this major will likely require them to travel to other institutions within the Five Colleges.

A minimum of 32 credits:

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH-101, MATH-102, and PHYS-110</td>
<td>Must be completed as prerequisites for the courses in this major.</td>
<td>4</td>
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<td>Select one of the following:</td>
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<tr>
<td>ASTR-100</td>
<td>Stars and Galaxies</td>
<td>4</td>
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<tr>
<td>ASTR-102</td>
<td>Solar Systems</td>
<td></td>
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<tr>
<td>ASTR-105</td>
<td>The Sky</td>
<td></td>
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<tr>
<td>PHYS-201</td>
<td>Electromagnetism</td>
<td>4</td>
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<tr>
<td>Two astronomy courses at the 200 level (8 credits) from the offerings of the Five College Astronomy department</td>
<td>8</td>
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<tr>
<td>One astronomy course at the 300 level (4 credits) from the offerings of the Five College Astronomy department</td>
<td>4</td>
<td></td>
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<tr>
<td>Two additional courses at the 300 level, in astronomy or a related field such as mathematics, physics, geology, biology, computer science, or the history or philosophy of science</td>
<td>8</td>
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<tr>
<td>One additional course at any level in astronomy or a related field such as mathematics, physics, geology, biology, computer science, or the history or philosophy of science</td>
<td>4</td>
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Total Credits: 32

Additional Specifications
• Students planning graduate study should generally regard this as a minimum program and include additional 300-level work. Advanced course work in physics and mathematics is especially encouraged for students wishing to pursue graduate studies in astronomy.

Requirements for the Minor
The goal of an astronomy minor is to provide a practical introduction to modern astronomy. If combined with a major in another science or mathematics-related field, such as geology, chemistry, or computer science, it can provide a versatile scientific background that prepares a student for future work as a scientist or technical specialist. Alternatively, the minor may be combined with a major in a nonscience field, such as history, philosophy, or education, for students who wish to apply their astronomical backgrounds in a broader context that could include history of science, scientific writing or editing, or science education.

A minimum of 16 credits:

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<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>One 300-level astronomy, physics, or geology course</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Three additional 200-level or 300-level courses in astronomy</td>
<td></td>
<td>12</td>
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</table>

Total Credits: 16
Course Offerings

**ASTR-100 Stars and Galaxies**  
*Fall. Credits: 4*

Discover how the forces of nature shape our understanding of the cosmos. Explore the origin, structure, and evolution of the earth, moons and planets, comets and asteroids, the sun and other stars, star clusters, the Milky Way and other galaxies, clusters of galaxies, and the universe as a whole.

*Applies to requirement(s): Math Sciences*

J. Young

**ASTR-102 Solar Systems**  
*Spring. Credits: 4*

Travel through our solar system using results of the latest spacecraft. Explore the origins of our worlds through the study of planet formation, meteorites, asteroids, and comets. Discover the processes that shape planetary interiors, surfaces, and atmospheres. Compare our solar system to others by learning about newly discovered exoplanets. Trace the conditions that may foster life throughout the solar system and beyond.

*Applies to requirement(s): Math Sciences*

J. Young

**ASTR-105 The Sky**  
*Fall and Spring. Credits: 4*

A hands-on introduction to observing and understanding the extraterrestrial sky. Daily and annual motions of the sun, moon, planets, and stars; celestial coordinate systems; apparent brightnesses and colors of the stars; time; calendars. Observations at the Williston Observatory with the unaided eye, visually with the eight-inch telescope, and by electronic camera with computer-controlled telescopes.

*Applies to requirement(s): Math Sciences*

J. Young

**ASTR-228 Astrophysics I: Stars and Galaxies**  
*Not Scheduled for This Year. Credits: 4*

A calculus-based introduction to the properties, structure, formation, and evolution of stars and galaxies. The laws of gravity, thermal physics, and atomic physics provide a basis for understanding observed properties of stars, interstellar gas, and dust. We apply these concepts to develop an understanding of stellar atmospheres, interiors, and evolution, the interstellar medium, and the Milky Way and other galaxies.

*Applies to requirement(s): Math Sciences*

J. Young

*Prereq: PHYS-110 and MATH-102.  
Advisory: PHYS-201 and MATH-203 strongly suggested.*

**ASTR-295 Independent Study**  
*Fall and Spring. Credits: 1 - 4*

The department  
Instructor permission required.

**ASTR-330 Topics in Astrophysics**  
*Not Scheduled for This Year. Credits: 4*

In-class discussions will be used to formulate a set of problems, each designed to illuminate a significant aspect of the topic at hand. The problems will be difficult and broad in scope: their solutions, worked out individually and in class discussions, will constitute the real work of the course. Students will gain experience in both oral and written presentation. Topics vary from year to year.

**ASTR-330AC Topics in Astrophysics: 'Asteroids and Comets'**  
*Not Scheduled for This Year.*

This course is an introduction to asteroids and comets from both an astronomical and geological point of view. Topics that will be covered will include how these objects are discovered, their orbits, the mineralogies of asteroids and meteorites, how these objects are classified, impact hazard scales, and space missions. This course is appropriate for any student interested in the properties of these small bodies.

*Applies to requirement(s): Math Sciences*

T. Burbine

**ASTR-330MA Topics in Astrophysics: 'Mars'**  
*Not Scheduled for This Year.*

This course will survey the past, present, and future of Mars exploration and science. We will focus on the evolution of Mars as a paradigm for terrestrial planets, with specific units on missions, formation, volcanism, impacts, glaciers and water, spectroscopy and mineralogy, climate, and issues pertaining to the possibilities of life on Mars. This is a discussion-based, interactive seminar with students and faculty reading current papers from the literature, supported by many outside speakers. Weekly writing assignments focus on critical thinking.

*Applies to requirement(s): Math Sciences*

M. Dyar

**ASTR-330MN Topics in Astrophysics: 'Moon'**  
*Fall. Credits: 4*

This course will survey the past, present, and future of the exploration and science of the Earth's Moon. We will have specific units on interiors, heat flow, thermal evolution, magnetism, volcanism, impacts, crustal composition and mineralogy, and spectroscopy of its surface. This is a discussion-based, interactive seminar with students and faculty reading current papers from the literature.

*Applies to requirement(s): Math Sciences*

M. Dyar

*Prereq: Any intermediate-level Astronomy or Geology course.  
Advisory: Astronomy 223 recommended.*
ASTR-330VE Topics in Astrophysics: 'Venus'

Not Scheduled for This Year. Credits: 4

This course will survey the past, present, and future of the exploration and science of the planet Venus. We will focus on the evolution of Venus as a paradigm for Earth's possible future. We will have specific units on interiors, heat flow, thermal evolution, magnetism, volcanism, impacts, crustal composition and mineralogy, and spectroscopy of its surface. This is a discussion-based, interactive seminar with students and faculty reading current papers from the literature.

 Applies to requirement(s): Math Sciences

M. Dyar

Prereq: Any intermediate-level Astronomy or Geology course.

Advisory: ASTR-223 recommended.

ASTR-335 Astrophysics II

Fall. Credits: 4

How do astronomers determine the nature and extent of the universe? Centering around the theme of the "Cosmic Distance Ladder," we explore how astrophysics has expanded our comprehension to encompass the entire universe. Topics include: the size of the solar system; parallactic and spectroscopic distances of stars; star counts and the structure of our galaxy; Cepheid variables and the distances of galaxies; the Hubble Law and large-scale structure in the universe; quasars and the Lyman-Alpha Forest.

 Applies to requirement(s): Math Sciences

J. Young

Prereq: ASTR-228.

ASTR-352 Astrophysics III

Spring. Credits: 4

Advanced course covering physical processes in the gaseous interstellar medium, including photoionization in HII regions and planetary nebulae, shocks in supernova remnants and stellar jets, and energy balance in molecular clouds. Dynamics of stellar systems, star clusters, and the virial theorem will also be discussed, along with galaxy rotation and the presence of dark matter in the universe, as well as spiral density waves. The course concludes with quasars and active galactic nuclei, synchrotron radiation, accretion disks, and supermassive black holes.

 Applies to requirement(s): Math Sciences

J. Young

Prereq: ASTR-335 or two physics courses at the 200 or 300 level.

ASTR-395 Independent Study

Fall and Spring. Credits: 1 - 8

The department

Instructor permission required.