Handbook for Astronomy Majors

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Department of Astronomy (www.astro.umass.edu)
University of Massachusetts, Amherst

Contact List:

Astronomy Department Main Office: Connie Milne, LGRT 619 E, (413) 545-2194
Department Head: Professor Stephen Schneider (413) 545-2076, schneider@astro.umass.edu
Undergraduate Program Director: Professor Ronald Snell (413) 545-1949, snell@astro.umass.edu
Chief Undergraduate Advisor and Honors Program Director: Professor Min Yun (413) 545-2215, myun@astro.umass.edu

Advising and Counseling Resources

Astronomy Department Academic Advisors:

Chief Undergraduate Advisor: Professor Min Yun
            LGRT 522, 545-2215, myun@astro.umass.edu

Advisor Class of 2018: Professor Todd Tripp
            LGRT 526, 545-3070, tripp@astro.umass.edu

Advisor Class of 2017: Professor Daniel Wang
            LGRT 517 G, 545-2131, mauro@astro.umass.edu

Advisor Class of 2016: Professor Mauro Giavalisco
            LGRT 520, 545-4767, mauro@astro.umass.edu

Advisor Class of 2015: Professor Martin Weinberg
            LGRT 530, 545-3821, weinberg@astro.umass.edu

Advisor Class of 2014: Professor Todd Tripp
            LGRT 526, 545-3070, tripp@astro.umass.edu

Transfer Advising: Professor Ronald Snell
            LGRT 517 K, 545-1949, snell@astro.umass.edu
Degree Requirements

University and College Requirements

To receive a bachelor's degree in astronomy, a student must meet the graduation requirement set by (1) the University, (2) the College of Natural Sciences and (3) the Department of Astronomy. The University requirements (total number of credits, number of credits in residence, GPA, general education requirements) are all explained in the Guide to Undergraduate Programs, available at www.umass.edu/ug_programguide/. We note that two of the general educations requirements (Junior Year Writing and Integrative Experience) are discipline specific and are also summarized under the Department requirements.

The College of Natural Science requirements for graduation are described on the College website at www.cns.umass.edu/academics/cns-degree-requirements/. Note that as of fall 2010, the College foreign language requirement has been removed for the B.S. degree, however it is still in effect for B.A. degrees.

Department Requirements

The Department offers both B.A. and B.S. degrees in astronomy. For the B.S. degree there are two tracks (Astrophysics track and the Space Science Track). If you are interested in adding an astronomy major or interesting in changing degree tracks, please consult one of our advisors and they can provide the form needed to make this change. The requirements for these degrees and degree tracks are summarized below.

We note that the requirements for the BA degree and the BS Space Science Track have been recently revised. Therefore students declaring the major fall 2013 or later have difference requirements that students declaring the major before fall 2013.
B.S. Astrophysics Track

The Astrophysics track is recommended to those students who want to pursue a graduate degree in astrophysics and related fields.

Astronomy Courses:

ASTRON 191A: First Year Seminar (1 credits, Fall semester only)

ASTRON 228: Stars and Galaxies (3 credits, Spring semester only)

ASTRON 301: Writing in Astronomy (3 credits, satisfies Junior year writing requirement – Spring semester only. Students with double majors should take the writing course offered by their primary major department.

ASTRON 339: Astronomy in a Global Context (3 credits, satisfies the integrative experience requirement for those for which this is required - Spring semester only) or PHYSICS 440

ASTRON 335: Modern Astrophysics (4 credits, Fall semester only)

ASTRON 452: Astrophysics II – Galaxies (4 credits, Spring semester only)

One additional course (at least 3 credits) at the 300+ level. Recommendations:

ASTRON 330: Topics in Astrophysics (3 credits.)
ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, fall semester)

Most faculty members in astronomy are engaged in basic research and undergraduate research opportunities are available through independent study, honor research and summer internships. Although not required, we encourage students to get involved in research.

Physics Courses:

PHYSICS 181: Physics I – Mechanics (4 credits with lab, Fall semester only)

PHYSICS 182: Physics II – Electricity and Magnetics (4 credits with lab, Spring semester only)

PHYSICS 281: Computational Physics (3 credits, Fall semester only)

PHYSICS 282: Techniques of Theoretical Physics (3 credits., Spring semester only)

PHYSICS 284 (and associated lab PHYSIC 286): Modern Physics I (4 credits., Spring semester only)

PHYSICS 287 (and associated lab PHYSIC 289): Physics III – Waves and Thermodynamics (4 credits, Fall semester only)

PHYSICS 421: Mechanics I (3 credits, Fall semester only)
PHYSICS 422: Intermediate Electricity and Magnetism (3 credits, Spring semester only)

PHYSICS 423: Statistical Physics (3 credits, Spring semester only)

PHYSICS 424: Quantum Mechanics (3 credits, Fall semester only)

Math Courses:

MATH 131: Calculus I (4 credits, fall or spring semesters)

MATH 132: Calculus II (4 credits, fall or spring semesters)

MATH 233: Multivariate Calculus (3 credits, fall or spring semesters)

MATH 331: Ordinary Differential Equations for Scientists and Engineers (3 credits, fall or spring semesters)

Suggested Course Schedule:

Freshman Year:

Fall: ASTRON 191A, PHYSIC 181, MATH 131
Spring: ASTRON 228, PHYSIC 182, MATH 132

Sophomore Year:

Fall: PHYSIC 281, PHYSIC 287/289. MATH 233
Spring: PHYSIC 282, PHYSIC 284/286, MATH 331

Junior/Senior Years:

Fall: ASTRON 335, PHYSIC 421, PHYSIC 424
Spring: ASTRON 301, ASTRON 339, ASTRON 452, PHYSIC 422, PHYSIC 423,
Either Fall or Spring: one elective 300+ course
B.S. Space Science Track  (students declaring the major before fall 2013)

The Space Science track is recommended for students pursuing an astronomy-related professional career after graduation.

Astronomy Courses:

ASTRON 191A:  First Year Seminar  (1 credits, Fall semester only)

ASTRON 228:  Stars and Galaxies (3 credits, Spring semester only)

ASTRON 301:  Writing in Astronomy (3 credits, satisfies Junior year writing requirement – Spring semester only.  Students with double majors should take the writing course offered by their primary major department.

ASTRON 339:  Astronomy in a Global Context (3 credits, satisfies the integrative experience requirement for those for which this is required - Spring semester only).  Students with double majors should take the integrative experience course offered by their primary major department.

ASTRON 335:  Modern Astrophysics (4 credits, Fall semester only)

Two additional courses (at least 3 credits each) at the 200+ level and one additional course (at least 3 credits) at the 300+ level (these could be in related fields such as Geoscience or Physics, however need Department Advisor Approval).  Some options for 200+ and 300+ level astronomy courses:

ASTRON 220:  Special Topics in Astronomy (3 credits, usually in fall)
ASTRON 223:  Planetary Science (3 credits, usually in fall semester)
ASTRON 224:  Stellar Astronomy (4 credits, usually in spring semester)
ASTRON 225:  Galactic and Extragalactic Astronomy (4 credits, usually offered in spring semester)
ASTRON 330:  Topics in Astrophysics (3 credits.)
ASTRON 337:  Techniques of Optical and Infrared Astronomy (4 credits, usually offered in Spring semester)

Most faculty members in astronomy are engaged in basic research and undergraduate research opportunities are available through independent study, honor research and summer internships.  Although not required, we encourage students to get involved in research.

Physics Courses:

PHYSICS 151:  General Physics I (4 credits, fall or spring semesters) or PHYSIC Physics I – Mechanics ( 4 credits with lab, Fall semester only)

PHYSICS 152:  General Physics II (4 credits, fall or spring semesters) or PHYSICS 182: Physics II – Electricity and Magnetics (4 credits with lab, Spring semester only)
PHYSICS 281: Computational Physics (3 credits, Fall semester only)

PHYSICS 284 (and associated lab PHYSIC 286): Modern Physics I (4 credits., Spring semester only) or PHYSICS 287 (and associated lab PHYSIC 289): Physics III – Waves and Thermodynamics (4 credits, Fall semester only)

Two additional elective Physics course at the 400+ level

**Math Courses:**

MATH 131: Calculus I (4 credits., fall or spring semesters)

MATH 132: Calculus II (4 credits., fall or spring semesters)

MATH 233: Multivariate Calculus (3 credits., fall or spring semesters)

**Suggested Course Schedule:**

Freshman Year:

Fall: ASTRON 191A, PHYSICS 151/181, MATH 131  
Spring: ASTRON 228, PHYSICS 152/182, MATH 132

Sophomore Year:

PHYSICS 281 (fall), PHYSICS 287/289 (fall) or PHYSICS 284/286 (spring semester). MATH 233 (fall or spring semester), and two additional 220+ level astronomy courses (fall or spring semester)

Junior/Senior Years:

ASTRON 301 (spring semester), ASTRON 335 (fall semester), ASTRON 339 (spring semester), two additional 400+ level physics courses (fall or spring) and one additional 300+ level astronomy course (fall or spring)
B.S. Space Science Track  (students declaring the major fall 2013 or later)

The Space Science track is recommended for students pursuing an astronomy-related professional career after graduation.

**Astronomy Courses:**

- ASTRON 191A:  First Year Seminar  (1 credits, Fall semester only)
- ASTRON 228:  Stars and Galaxies (3 credits, Spring semester only)
- ASTRON 301:  Writing in Astronomy (3 credits, satisfies Junior year writing requirement – Spring semester only.  Students with double majors should take the writing course offered by their primary major department.
- ASTRON 339:  Astronomy in a Global Context (3 credits, satisfies the integrative experience requirement for those for which this is required - Spring semester only).  Students with double majors should take the integrative experience course offered by their primary major department.
- ASTRON 335:  Modern Astrophysics (4 credits, Fall semester only)

Two  additional courses (each at least 3 credits) at the 200+ level and one additional course (at least 3 credits) at the 300+ level (these could be in related fields such as Geoscience or Physics).

Some options for 200+ and 300+ level astronomy courses:

- ASTRON 220:  Special Topics in Astronomy (3 credits, usually in fall)
- ASTRON 223: Planetary Science (3 credits, usually in fall semester)
- ASTRON 224:  Stellar Astronomy (4 credits, usually in spring semester)
- ASTRON 225:  Galactic and Extragalactic Astronomy (4 credits, usually offered in spring semester)
- ASTRON 330:  Topics in Astrophysics (3 credits.)
- ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, usually offered in Spring semester)

Most faculty members in astronomy are engaged in basic research and undergraduate research opportunities are available through independent study, honor research and summer internships. Although not required, we encourage students to get involved in research.

**Physics Courses:**

- PHYSICS 151:  General Physics I (4 credits, fall or spring semesters) or PHYSIC 181 Physics I – Mechanics (4 credits with lab, Fall semester only)
- PHYSICS 152:  General Physics II (4 credits, fall or spring semesters) or PHYSICS 182: Physics II – Electricity and Magnetics (4 credits with lab, Spring semester only)
- PHYSICS 281:  Computational Physics (3 credits, Fall semester only)
PHYSICS 284 (and associated lab PHYSIC 286): Modern Physics I (4 credits, Spring semester only)

PHYSICS 287 (and associated lab PHYSIC 289): Physics III – Waves and Thermodynamics (4 credits, Fall semester only)

One additional elective Physics course (at least 3 credits) at the 400+ level

Math Courses:

MATH 131: Calculus I (4 credits, fall or spring semesters)
MATH 132: Calculus II (4 credits, fall or spring semesters)
MATH 233: Multivariate Calculus (3 credits, fall or spring semesters)

Concentration Requirement:

Three courses (each at least 3 credits) in a related field. Students should consult with their Department Advisor to formulate a plan and get approval.

Suggested Course Schedule:

Freshman Year:

Fall: ASTRON 191A, PHYSICS 151/181, MATH 131
Spring: ASTRON 228, PHYSICS 152/182, MATH 132

Sophomore Year:

PHYSICS 281 (fall), PHYSICS 287/289 (fall), PHYSICS 284/286 (spring semester). MATH 233 (fall or spring semester), and two additional 220+ level astronomy courses (fall or spring semester), concentration courses

Junior/Senior Years:

ASTRON 301 (spring semester), ASTRON 335 (fall semester), ASTRON 339 (spring semester), one additional 400+ level physics courses (fall or spring) and one additional 300+ level astronomy course (fall or spring), concentration courses
B.A. Degree (for students declaring the major before fall 2013)

The B.A. degree is designed for students seeking careers in teaching, museum work, science writing, pre-med, etc.

Astronomy Courses:

ASTRON 191A: First Year Seminar (1 credits, Fall semester only)

ASTRON 224: Stellar Astronomy (4 credits, usually in spring semester) or ASTRON 225: Galactic and Extragalactic Astronomy (4 credits, usually offered in spring semester)

ASTRON 228: Stars and Galaxies (3 credits, Spring semester only)

ASTRON 301: Writing in Astronomy (3 credits, satisfies Junior year writing requirement – Spring semester only. Students with double majors should take the writing course offered by their primary major department.

ASTRON 339: Astronomy in a Global Context (3 credits, satisfies the Integrative Experience requirement for those for which this is required - Spring semester only). Students with double majors should take the writing course offered by their primary major department.

ASTRON 335: Modern Astrophysics (4 credits, Fall semester only)

Two additional courses (at least 3 credits each) at the 200+ level and eight additional credits at the 300+ level in astronomy (can also be in closely related subjects such as Geoscience or Physics, but need approval by Department Advisor). Some options for 200+ and 300+ level astronomy courses:

- ASTRON 220: Special Topics in Astronomy (3 credits, usually in fall)
- ASTRON 223: Planetary Science (3 credits, usually in fall semester)
- ASTRON 330: Topics in Astrophysics (3 credits.)
- ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, usually offered in Spring semester)

Physics Courses:

PHYSICS 131: Introductory Physics I (4 credits with lab, fall or spring semesters) or PHYSICS 151: General Physics I (4 credits with lab, fall semester only)

PHYSICS 132: Introductory Physics II (4 credits with lab, fall or spring semesters) or PHYSICS 152: General Physics II (4 credits, offered fall and spring semesters)

Math Courses:

MATH 127: Calculus for Life and Social Sciences I (3 credits, fall or spring semesters) or MATH 131: Calculus I (4 credits., fall or spring semesters)
MATH 128: Calculus for Life and Social Sciences II (3 credits, fall or spring semesters) or
MATH 132: Calculus II (4 credits, fall or spring semesters)

**Suggested Course Schedule:**

**Freshman Year:**

- **Fall:** ASTRON 191A, PHYSICS 131/151, MATH 127/131
- **Spring:** PHYSICS 132/152, MATH 128/132

**Sophomore Year:**

- ASTRON 224/225 (spring semester), ASTRON 228 (spring semester), and two additional 220+ level astronomy courses.

**Junior/Senior Years:**

- ASTRON 301 (spring semester), ASTRON 335 (fall semester), ASTRON 339 (spring semester), eight additional credits at the 300+ level to complete requirements.

**B.A. Degree (for students declaring the major fall 2013 or later)**

The B.A. degree is designed for students seeking careers in teaching, museum work, science writing, pre-med, etc.

**Astronomy Courses:**

- **ASTRON 191A:** First Year Seminar (1 credits, Fall semester only)

- **ASTRON 224:** Stellar Astronomy (4 credits, usually in spring semester) or ASTRON 225: Galactic and Extragalactic Astronomy (4 credits, usually offered in spring semester)

- **ASTRON 228:** Stars and Galaxies (3 credits, Spring semester only)

- **ASTRON 301:** Writing in Astronomy (3 credits, satisfies Junior year writing requirement – Spring semester only. Students with double majors should take the writing course offered by their primary major department.

- **ASTRON 339:** Astronomy in a Global Context (3 credits, satisfies the Integrative Experience requirement for those for which this is required - Spring semester only). Students with double majors should take the writing course offered by their primary major department.

- **ASTRON 335:** Modern Astrophysics (4 credits, Fall semester only)
Two additional courses (at least 3 credits each) at the 200+ level and one additional course (at least 3 credits) at the 300+ level in astronomy (can also be in closely related subjects such as Geoscience or Physics, but need approval by Department Advisor). Some options for 200+ and 300+ level astronomy courses:

ASTRON 220: Special Topics in Astronomy (3 credits, usually in fall)
ASTRON 223: Planetary Science (3 credits, usually in fall semester)
ASTRON 330: Topics in Astrophysics (3 credits.)
ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, usually offered in Spring semester)

Physics Courses:

PHYSICS 151: General Physics I (4 credits with lab, fall or spring semesters)
PHYSICS 152: General Physics II (4 credits, fall or spring semesters)
PHYSICS 281: Computational Physics (3 credits, Fall semester only)
PHYSICS 284 (and associated lab PHYSIC 286): Modern Physics I (4 credits., Spring semester only)

Math Courses:

MATH 131: Calculus I (4 credits., fall or spring semesters)
MATH 132: Calculus II (4 credits., fall or spring semesters)

Suggested Course Schedule:

Freshman Year:

Fall: ASTRON 191A, PHYSICS 151, MATH 131
Spring: PHYSICS 152, MATH 132

Sophomore Year:

ASTRON 224/225 (spring semester), ASTRON 228 (spring semester), and two additional 220+ level astronomy courses, PHYSICS 281, PHYSICS 284/286

Junior/Senior Years:

ASTRON 301 (spring semester), ASTRON 335 (fall semester), ASTRON 339 (spring semester), one additional 300+ level astronomy.
Minor in Astronomy

Requirements for a Minor in astronomy consists of taking ASTRON 228 and four additional courses at the 200+ level.

Honors in Astronomy

Departmental Honors is an Advanced Scholarship track of Commonwealth Honors College. Students may complete Departmental Honors as part of the full Commonwealth Honors College curriculum, which includes Honors General Studies, or they may complete Departmental Honors alone.

Students who are not already members of Commonwealth Honors College must apply to Departmental Honors via the online application using the following link: http://www.honors.umass.edu/admissions/apply-current-students. Admission to Departmental Honors will be at the discretion of the Honors Program Director. Minimally, to be eligible to apply for Departmental Honors, students must have (1) an overall GPA of 3.40 or higher earned after one fulltime semester of UMass Amherst coursework, (2) the ability to complete the Departmental Honors-Track requirements, and (3) the ability to complete the Commonwealth Honors College residency requirement of 45-graded credits (not pass/fail) earned at UMass Amherst (not transferred).

The Astronomy requirements for the completion of Departmental Honors are the following:

One honors course chosen from ASTRON 224, 225, 335 or 337

One additional astronomy honors course 300-level or higher

Honors Thesis or Project (students will need to sign up for ASTRON 499Y and 499T and file a proposal with the Commonwealth Honors College)

For more information about Departmental Honors in Astronomy, speak with our Honors Program Director Professor Min Yun.

Five College Interchange

The undergraduate curriculum is shared among the Five Colleges, therefore you may want or need to take an astronomy course at one of the other campuses. Enrollment for these off-campus classes are handled by the Five College Interchange office located in 613 Goodell. Steps for registration are the following:

1) Identify courses from the Five College Course Catalog (or from the Department website). No more than 8 credits can be taken at any one of the other four institutions per semester.
2) Locate the Five College Enrollment Request Form on your SPIRE account. Log on to Spire and under “Enrollment” follow the link for Five College Enrollment Request. Read the two pages of instructions and enter you course information onto the form (handwritten forms will not be accepted).

3) Print out TWO copies of the form.

4) Acquire instructor signatures:
   During pre-registration: IF the course has limited enrollment, requires prerequisites, or requires instructor's permission.
   During the Add/Drop registration - All courses require the instructor's signature.

5) If you want the course to fulfill a requirement for you major or minor have your major or minor advisor sign the appropriate line on the Five College Enrollment Request Form.

6) Bring both copies (with signatures) to the Five College Interchange Office in 613 Goodell before the end of the registration deadline.

For additional information go to the following website:
http://ualc.umass.edu/five_college_interchange/

**Independent Study**

Students may wish to concentrate on topics or research outside to the classroom. Opportunities for this type of investigation exist through the Independent Study courses (ASTRON 196, 296, 396 and 496). These courses are arranged on a semester basis between a student and a professor. Depending on the type of activity, these classes generally range from 1 to 3 credits.

There are also many summer intern programs in astronomy. A list of these Research Experiences for Undergraduates can be found on the American Astronomical Society's website:

In addition to the REU programs funded by the National Science Foundation and listed on the AAS website, the Five College Astronomy Department runs a summer research intern program each summer for astronomy students within the Five Colleges. Details of this program can be found at: http://www.astro.umass.edu/~wqd/REU_astro/index.html. We encourage students to take advantage of these intern programs.
Careers in Astronomy

Below is a list of websites that provide information about careers in astronomy:


National Optical Astronomical Observatories' FAQs about a career in astronomy: http://www.noao.edu/education/being-an-astronomer.php

American Astronomical Society's career guide for professional astronomers: http://aas.org/career