

Handbook for Astronomy Majors

September 2023

Department of Astronomy (www.astro.umass.edu)

Contact List:

Department Head:	Professor Daniela Calzetti (413) 545-3556, calzetti@astro.umass.edu
Chief Undergraduate Advisor	Professor Todd Tripp (413) 577-3070, tripp@astro.umass.edu
Honors Program Director:	Professor Min Yun (413) 545-2215, myun@astro.umass.edu
Undergraduate Program Director:	Professor Ronald Snell (413) 545-1949, snell@astro.umass.edu

Advising and Counseling Resources

Astronomy Department Academic Advisors:

Advisor Class of 2027: Professor Daniel Wang
LGRC 517 G, 545-2131, wqd@umass.edu

Advisor Class of 2027: Professor Mauro Giavalisco
LGRC 520, 545-4767, mauro@astro.umass.edu

Advisor Class of 2026: Professor Daniela Calzetti
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Advisor Class of 2026: Professor Min Yun
LGRC 522, 545-2215, myun@astro.umass.edu

Advisor Class of 2025: Professor Todd Tripp
LGRC 526, 545-3070, tripp@astro.umass.edu

Advisor Class of 2024: Professor Alexandra Pope
LGRC 618, 545-1769, pope@astro.umass.edu

Advisor Class of 2024: Professor Katherine Whitaker
LGRC 524, 545-3556, kwhitaker@astro.umass.edu

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

The College of Natural Sciences Advising Center:

220 Morrill II Science Center, 545-1969

www.umass.edu/natural-sciences/advising/cns-undergraduate-advising-center

The College of Natural Sciences Career and Professional Development Center:

215 Morrill III Science Center, 545-2238

www.umass.edu/natural-sciences/advising/careers

University Career Services:

511 Goodell Building 545-2224

www.umass.edu/careers/career-journey-overview

University Counseling Services:

Middlesex House, 545-2337 or 545-0333

www.umass.edu/counseling/

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/undergradguide/2023/2024/default.html. We note that two of the general education 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.umass.edu/natural-sciences/academics/degree-requirements/. For a BS degree the College of Natural Science requires 60 credits of coursework in departments within the college. For a BA degree there is a foreign language requirement (see College website for details)..

Department Requirements

The Department offers both BA and BS degrees in astronomy. For the BS degree there are two tracks or subplans (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. The requirements for these degrees and degree tracks are summarized below.

Note that the requirements for both the BA and BS degrees has been recently revised. Therefore students starting Fall 2023 or later have difference requirements that students starting before Fall 2023.

BS Astrophysics Track (starting before Fall 2023):

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 credit, Fall semester only)

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

JUNIOR YEAR WRITING: Students whose primary major is astronomy should take ASTRON 301: Writing in Astronomy (3 credits, Fall semester only) to satisfy the Junior Year Writing requirement. Students whose primary major is not astronomy, only need take the junior year writing course offered in their primary major.

INTEGRATIVE EXPERIENCE: Students whose primary major is astronomy can take either ASTRON 339: Astronomy in a Global Context (3 credits, Spring semester only) or PHYSICS 440: Intermediate Lab (4 credits, Fall and Spring semesters) to satisfy the Integrative Experience requirement. Students whose primary major is not astronomy, only need to take the integrative experience course offered in their primary major.

ASTRON 335: Astrophysics II: Stellar Structure and Evolution (4 credits, Fall semester only)

ASTRON 452: Astrophysics III: Galaxies and the Universe (4 credits, Spring semester only)

One additional astronomy course (at least 3 credits) at the 300 level or higher.

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 Magnetism (4 credits with lab, Spring semester only)

PHYSICS 281: Computational Physics (3 credits, Fall or Spring semesters)

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 (4 credits, Fall semester only)

PHYSICS 422: Intermediate Electricity and Magnetism (4 credits, Spring semester only)

PHYSICS 423: Statistical Physics (4 credits, Spring semester only)

PHYSICS 424: Quantum Mechanics (4 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, ASTRON 301
Spring: ASTRON 339, ASTRON 452, PHYSIC 422, PHYSIC 423,
Either Fall or Spring: one elective 300+ course

BS Astrophysics Track (starting Fall 2023 or later):

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: Astrophysics I: Stars and Galaxies (3 credits, Spring semester only)

JUNIOR YEAR WRITING: Students whose primary major is astronomy should take ASTRON 301: Writing in Astronomy (3 credits, Fall semester only) to satisfy the Junior Year Writing requirement. Students whose primary major is not astronomy, only need take the junior year writing course offered in their primary major.

INTEGRATIVE EXPERIENCE: Students whose primary major is astronomy can take either ASTRON 339: Astronomy in a Global Context (3 credits, Spring semester only) or PHYSICS 440: Intermediate Lab (4 credits, Fall and Spring semesters) to satisfy the Integrative Experience requirement. Students whose primary major is not astronomy, only need to take the integrative experience course offered in their primary major.

ASTRON 335: Astrophysics II: Stellar Structure and Evolution (4 credits, Fall semester only)

ASTRON 452: Astrophysics III: Galaxies and the Universe (4 credits, Spring semester only)

One additional astronomy course (at least 3 credits) at the 300-level or higher. ASTRON 339 cannot be used to satisfy this requirement if used to satisfy the IE requirement. Independent study, practicum, honors project, honors thesis and honors research cannot be used to satisfy this requirement. 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 Magnetism (4 credits with lab, Spring semester only)

PHYSICS 271: Mathematical Methods of Physics I (3 credits, Fall semester only)

PHYSICS 272: Physics III: Thermodynamics, Optics and Special Relativity (3 credits, Fall semester only) and PHYSICS 273: Sophomore Lab I (2 credits, Fall semester only)

PHYSICS 275: Mathematical Methods of Physics II (3 credits, Spring semester only)

PHYSICS 276: Physics IV: Introduction to Waves and Quantum Mechanics (3 credits, Spring semester only) and PHYSICS 277: Sophomore Lab II (2 credits, Spring semester only)

PHYSICS 281: Computational Physics (3 credits, Fall or Spring semesters)

PHYSICS 421: Mechanics I (4 credits, Fall semester only)

PHYSICS 422: Intermediate Electricity and Magnetism (4 credits, Spring semester only)

PHYSICS 423: Statistical Physics (4 credits, Spring semester only)

PHYSICS 424: Quantum Mechanics (4 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)

Suggested Course Schedule:

Freshman Year:

Fall: ASTRON 191A, PHYSIC 181, MATH 131

Spring: ASTRON 228, PHYSIC 182, MATH 132

Sophomore Year:

Fall: PHYSICS 271, PHYSIC 272/273, MATH 233

Spring: PHYSICS 275, PHYSIC 276/277, PHYSICS 281

Junior/Senior Years:

Fall: ASTRON 335, PHYSIC 421, PHYSIC 424, ASTRON 301

Spring: ASTRON 339, ASTRON 452, PHYSIC 422, PHYSIC 423,

Either Fall or Spring: one astronomy elective at 300-level or higher

BS Space Science Track (starting before Fall 2023)

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: Astrophysics I: Stars and Galaxies (3 credits, Spring semester only)

JUNIOR YEAR WRITING: Students whose primary major is astronomy should take ASTRON 301: Writing in Astronomy (3 credits, Fall semester only) to satisfy the Junior Year Writing requirement. Students whose primary major is not astronomy, only need take the junior year writing course offered in their primary major.

INTEGRATIVE EXPERIENCE: Students whose primary major is astronomy can take either ASTRON 339: Astronomy in a Global Context (3 credits, Spring semester only) or PHYSICS 440: Intermediate Lab (4 credits, Fall and Spring semesters) to satisfy the Integrative Experience requirement. Students whose primary major is not astronomy, only need to take the integrative experience course offered in their primary major.

ASTRON 335: Astrophysics II: Stellar Structure and Evolution (4 credits, Fall semester only)

Three additional courses (at least 3 credits each) all at the 200 level or higher and one of these three courses must be at the 300 level or higher. The 300+ level course 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)

ASTRON 223: Planetary Science (3 credits)

ASTRON 330: Topics in Astrophysics (3 credits.)

ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, fall semester only)

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:

PHYSIC 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 or Spring semester)

PHYSICS 284 (and associated lab PHYSIC 286): Modern Physics (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. The courses used to satisfy the concentration requirement cannot be used to satisfy any of the requirements listed above. Students should consult with their Department Advisor to formulate a plan. Each student will need to submit a 1 page proposal outlining the 3 courses and the rationale behind them. This proposal will need to be approved by a Department Advisor (the advisor should enter the approved plan in the SPIRE notes).

Examples of Concentration Programs

1. Astrobiology
 - a. Bio 151,152+153(lab), 285 (cell and molecular biology)
2. Astro-Chemistry
 - a. Chem 111, 112, and 261: The combination of inorganic and organic chemistry will allow students to get a better handle on chemistry as a whole to then apply this basic understanding to spectroscopic results of pre-biotic molecules. Having organic chemistry 1 will open the doors to begin building a better knowledge of the synthesis of molecules, why molecules form in regio-specific manners and adopt certain isomers. It will serve as a foundation for insight into what molecules cannot be found on Earth but why they may be found in interstellar space.
3. Astronomy and Math

- a. Math 235, 331, and 551 (Int Scientific Computing)
 - b. Math 235, 331, and Statistics 515
4. Astronomy and Geoscience
- a. Geology 311 (Mineralogy), 321 (Petrology), and 445 (Structural Geology): These courses focus on the chemical and physical properties of minerals, rocks and the larger structures rock make up like tectonic plates. These courses are vital for understanding the formation, dynamics, and possible environments of, not only Earth, but also all bodies composed of similar materials.
 - b. Geology 321 (Petrology), 441 (Structural Geology), 445 (Sedimentology): These classes will provide knowledge that is crucial to understanding the geologic history and evolution of planetary bodies, and by extension the history and possible future for our home planet
 - c. Geology 201 (History of the Earth), Geology 231 (Geology Field Methods), and Geology 354 (Climatology)
 - d. Geology 201 (History of the Earth), Geology 231 (Geology Field Methods), and Geology 311 (Mineralogy)
5. Astronomy and Computer Science
- a. Computer Science 187 (Programming with Data Structures), Computer Science 250 (Introduction to Computation), and Computer Science 240 (Reasoning under Uncertainty)
6. Astronomy and Mechanical Engineering
- a. MIE 230 (Thermodynamics), MIE 340 (Fluid Mechanics), MIE 354 (Heat Transfer)
 - b. MIE 211 (Strengths of Materials), MIE 313 (Design of Mechanical Components), and MIE 354 (Heat Transfer)

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 (fall 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

BS Space Science Track (starting Fall 2023 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: Astrophysics I: Stars and Galaxies (3 credits, Spring semester only)

JUNIOR YEAR WRITING: Students whose primary major is astronomy should take ASTRON 301: Writing in Astronomy (3 credits, Fall semester only) to satisfy the Junior Year Writing requirement. Students whose primary major is not astronomy, only need take the junior year writing course offered in their primary major.

INTEGRATIVE EXPERIENCE: Students whose primary major is astronomy can take either ASTRON 339: Astronomy in a Global Context (3 credits, Spring semester only) or PHYSICS 440: Intermediate Lab (4 credits, Fall and Spring semesters) to satisfy the Integrative Experience requirement. Students whose primary major is not astronomy, only need to take the integrative experience course offered in their primary major.

ASTRON 335: Astrophysics II: Stellar Structure and Evolution (4 credits, Fall semester only) or ASTRON 452: Astrophysics III: Galaxies and the Universe (4 credits, Spring semester only)

Three additional courses (at least 3 credits each), two at the 200-level or higher and one at the 300-level or higher. Some options for 200 and 300-level astronomy courses:

ASTRON 220: Special Topics in Astronomy (3 credits)

ASTRON 223: Planetary Science (3 credits)

ASTRON 226: Cosmology (3 credits)

ASTRON 330: Topics in Astrophysics (3 credits.)

ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, fall semester only)

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 271: Mathematical Methods of Physics I (3 credits, Fall semester only)

PHYSICS 272: Physics III: Thermodynamics, Optics and Special Relativity (3 credits, Fall semester only) and PHYSICS 273: Sophomore Lab I (2 credits, Fall semester only)

PHYSICS 276: Physics IV: Introduction to Waves and Quantum Mechanics (3 credits, Spring semester only) and PHYSICS 277: Sophomore Lab II (2 credits, Spring semester only)

PHYSICS 281: Computational Physics (3 credits, Fall or Spring semesters)

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. The courses used to satisfy the concentration requirement cannot be used to satisfy any of the requirements listed above. Students should consult with their Department Advisor to formulate a plan. Each student will need to submit a 1 page proposal outlining the 3 courses and the rationale behind them. This proposal will need to be approved by a Department Advisor (the advisor should enter the approved plan in the SPIRE notes).

Examples of Concentration Programs

7. Astrobiology

- a. Bio 151,152+153(lab), 285 (cell and molecular biology)

8. Astro-Chemistry

- a. Chem 111, 112, and 261: The combination of inorganic and organic chemistry will allow students to get a better handle on chemistry as a whole to then apply this basic understanding to spectroscopic results of pre-biotic molecules. Having organic chemistry 1 will open the doors to begin building a better knowledge of the synthesis of molecules, why molecules form in regio-specific manners and adopt certain isomers. It will serve as a foundation for insight into what molecules cannot be found on Earth but why they may be found in interstellar space.

9. Astronomy and Math

- a. Math 235, 331, and 551 (Int Scientific Computing)
- b. Math 235, 331, and Statistics 515

10. Astronomy and Geoscience

- a. Geology 311 (Mineralogy), 321 (Petrology), and 445 (Structural Geology): These courses focus on the chemical and physical properties of minerals, rocks and the larger structures rock make up like tectonic plates. These courses are vital for understanding the formation, dynamics, and possible environments of, not only Earth, but also all bodies composed of similar materials.
- b. Geology 321 (Petrology), 441 (Structural Geology), 445 (Sedimentology): These classes will provide knowledge that is crucial to understanding the geologic history and evolution of planetary bodies, and by extension the history and possible future for our home planet
- c. Geology 201 (History of the Earth), Geology 231 (Geology Field Methods), and Geology 354 (Climatology)
- d. Geology 201 (History of the Earth), Geology 231 (Geology Field Methods), and Geology 311 (Mineralogy)

11. Astronomy and Computer Science

- a. Computer Science 187 (Programming with Data Structures), Computer Science 250 (Introduction to Computation), and Computer Science 240 (Reasoning under Uncertainty)

12. Astronomy and Mechanical Engineering

- a. MIE 230 (Thermodynamics), MIE 340 (Fluid Mechanics), MIE 354 (Heat Transfer)
- b. MIE 211 (Strengths of Materials), MIE 313 (Design of Mechanical Components), and MIE 354 (Heat Transfer)

Suggested Course Schedule:

Freshman Year:

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

Sophomore Year:

Fall: PHYSICS 271, PHYSICS 272/273, MATH 233
Spring: PHYSICS 276/277, PHYSICS 281
Fall or Spring: elective 200+ level astronomy courses, concentration courses

Junior/Senior Years:

Fall: ASTRON 301, ASTRON 335 (fall semester)
Spring: ASTRON 339
Fall or Spring: one additional 400+ level physics courses, 200+ and 300+ astronomy electives, concentration courses

BA Degree (Students starting before Fall 2023)

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 credit, Fall semester only)

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

JUNIOR YEAR WRITING: Students whose primary major is astronomy should take ASTRON 301: Writing in Astronomy (3 credits, Fall semester only) to satisfy the Junior Year Writing requirement. Students whose primary major is not astronomy, only need take the junior year writing course offered in their primary major.

INTEGRATIVE EXPERIENCE: Students whose primary major is astronomy can take ASTRON 339: Astronomy in a Global Context (3 credits, Spring semester only) to satisfy the Integrative Experience requirement. Students whose primary major is not astronomy, only need to take the integrative experience course offered in their primary major.

ASTRON 335: Astrophysics II: Stellar Structure and Evolution (4 credits, Fall semester only)

Three additional astronomy courses (at least 3 credits each) and one of these three additional courses must be at the 300 level or higher. The 300+ level course 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)
- ASTRON 223: Planetary Science (3 credits, usually in spring semester)
- ASTRON 330: Topics in Astrophysics (3 credits.)
- ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, fall semester)

Physics Courses:

PHYSIC 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 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)

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, MATH 131
Spring: PHYSICS 152, MATH 132

Sophomore Year:

ASTRON 228 (spring semester), and one additional 200+ level astronomy courses,
PHYSICS 281 (fall semester), PHYSICS 284/286 (spring semester), PHYSICS
287/289 (fall semester), MATH 233

Junior/Senior Years:

ASTRON 301 (fall semester), ASTRON 335 (fall semester), ASTRON 339 (spring semester), two additional 200+ level astronomy course and one additional 300+ level astronomy course

BA Degree (Students starting Fall 2023 and 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 credit, Fall semester only)

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

JUNIOR YEAR WRITING: Students whose primary major is astronomy should take ASTRON 301: Writing in Astronomy (3 credits, Fall semester only) to satisfy the Junior Year Writing requirement. Students whose primary major is not astronomy, only need take the junior year writing course offered in their primary major.

INTEGRATIVE EXPERIENCE: Students whose primary major is astronomy can take ASTRON 339: Astronomy in a Global Context (3 credits, Spring semester only) to satisfy the Integrative Experience requirement. Students whose primary major is not astronomy, only need to take the integrative experience course offered in their primary major.

ASTRON 335: Astrophysics II: Stellar Structure and Evolution (4 credits, Fall semester only) or ASTRON 452: Astrophysics III: Galaxies and the Universe (4 credits, Spring semester only)

Three additional astronomy courses (at least 3 credits each) and one of these three additional course must be at the 300 level or higher. The 300+ level course 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)

ASTRON 223: Planetary Science (3 credits, usually in spring semester)

ASTRON 330: Topics in Astrophysics (3 credits.)

ASTRON 337: Techniques of Optical and Infrared Astronomy (4 credits, fall semester)

Physics Courses:

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

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

PHYSICS 272: Physics III: Thermodynamics, Optics and Special Relativity (3 credits, Fall semester only) and PHYSICS 273: Sophomore Lab I (2 credits, Fall semester only)

PHYSICS 276: Physics IV: Introduction to Waves and Quantum Mechanics (3 credits, Spring semester only) and PHYSICS 277: Sophomore Lab II (2 credits, Spring semester only)

PHYSICS 281: Computational Physics (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)

Suggested Course Schedule:

Freshman Year:

Fall: ASTRON 191A, PHYSICS 181, MATH 131

Spring: PHYSICS 182, MATH 132

Sophomore Year:

ASTRON 228 (spring semester), and one additional 200+ level astronomy courses, PHYSICS 281 (spring semester), PHYSICS 272/273 (fall semester), PHYSICS 276/277 (spring semester), MATH 233

Junior/Senior Years:

ASTRON 301 (fall semester), ASTRON 335 (fall semester), ASTRON 339 (spring semester), two additional 200+ level astronomy course and one additional 300+ level astronomy course

Minor in Astronomy

Requirements for a Minor in astronomy consists of taking ASTRON 228 and four additional astronomy 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](#). 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

- an overall GPA of 3.40 or higher earned after one fulltime semester of UMass Amherst coursework,
- the ability to complete the Departmental Honors-Track requirements, and
- 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 335, 337 or 452
- 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](#)). **A thesis proposal should be submitted to the department Honors Program Director for approval at least one week in advance of the Honors College deadline.**

For more information about Departmental Honors in Astronomy, contact 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.

Step by Step Instructions

- Identify course(s) from [Five College Course Catalog](#). Do not request more than 8 credits at any one institution.
 - Log into Spire
 - Go to Manage Classes
 - Go to Add/Drop/edit Classes
 - Scroll down to FIVE COLLEGE ENROLLMENT
 - Click on FIVE COLLEGE ENROLLMENT
 - Fill in all the information about the course.
 - The Five College Registration page appears, read and click through to the Request Form.
 - You will see a Course Registration Receipt. **Save the Registration Receipt as a PDF** not as a picture or screen shot.
 - Click Submit. **YOU ARE NOT DONE**
 - If the Registration Receipt says you must get instructor permission (always the case during add-drop at the beginning of the semester, not always the case during pre-registration) email the instructor, attaching the receipt for a signature.
 - If the instructor cannot sign the actual form, an email verifying approval to enroll in the class is sufficient. **YOU ARE NOT DONE**

- Email the PDF Registration Receipt and instructor approval to 5collreg@acad.umass.edu. If the instructor approval is an email, please submit it with the PDF Registration Receipt in the same email.
- The Five College Interchange office will process the Registration Receipt if there are enough credits available on your schedule to add the course. It is your responsibility to ensure you have enough credits available.
- You can check the status of the Registration on the Spire page in the Five College Enrollment
- Please send one email for each course, attaching the receipt and if required the instructor permission.

By submitting your Five College Registration Receipt, YOU AGREE to abide by all academic and student conduct regulations at the host school, including attendance, academic honesty, pass-fail procedures, and deadlines for completing course work and taking examinations.

Registration dates are strict, so be sure to know when they occur.

For additional information go to the following website:

<http://www.umass.edu/fivecollegeinterchange/>

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:

<http://aas.org/learn/internships-scholarships>.

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/academics/five-college-astronomy-undergraduate-internship-program>. We encourage students to take advantage of these intern programs.

Scholarships, Internships, and Career Information

[The College of Natural Sciences](#) is your primary source of general scholarships. You have access to additional general scholarships if you are a member of the [Commonwealth Honors College](#). The list of outside scholarships and fellowships are highly incomplete, and they will be updated with new information (let me know if you come across others). For the Internships and Career Information/Advice, I strongly recommend starting on the [AAS Career](#) and [AstroBetter](#) pages to educate yourself first. Most of the national and international

opportunities are found there, but some of the major programs of interest are listed below, including some international programs that you might not easily find elsewhere.