# **ASTRONOMY MAJOR**

# **MAJOR DESCRIPTION**

The Major in Astronomy (ASTR) enables students to explore the foundational concepts and recent discoveries that have shaped the modern study of celestial objects, space, the phenomena of the cosmos, and the universe. Students develop advanced proficiency with the theoretical concepts and observational tools employed in distinct subfields of astrophysics. The program blends coursework with research opportunities and provides students with access to professional-quality telescopes, instrumentation, and computers. All majors complete an in-depth senior capstone project and present their research in a public forum, e.g., by speaking in the research seminar, presenting a poster at the Wesleyan summer research program, or presenting at a professional conference.

The Astronomy program attracts students who have a passionate interest and curiosity about space, celestial objects, and the universe, along with an aptitude for mathematics and physics, the ability to work with complex data and technology, and the patience for long-term research projects.

Astronomy graduates may continue their studies in a graduate program or pursue a variety of careers in fields such as astronomy, astrophysics, data science, planetary science, aerospace engineering, space missions, science communications, education, and public outreach.

#### **ADMISSION TO THE MAJOR**

The standard introductory course for potential majors and other scienceoriented students is ASTR155. It may be taken in the first or sophomore year. It assumes a good high school preparation in physics and some knowledge of calculus. ASTR211 is a sophomore-level course appropriate for interested nonmajors as well as a gateway course to the major. Coding skills are required for ASTR211 and all upper-level astronomy courses. Prospective majors should take ASTR210 prior to ASTR211 or demonstrate their proficiency in coding to the ASTR211 instructor prior to taking that course. View courses in our Academic Catalog (https://catalog.wesleyan.edu/departments/astr/ugrd-astr/).

#### **MAJOR REQUIREMENTS**

The astronomy major is constructed to accommodate both students who are preparing for graduate study and those who are not.

The basic requirement for the major is the successful completion of the required courses as well as four upper-level astronomy courses. The required upper-level courses are taken one each semester in the junior and senior years.

| Code |                   | Title  | Hours |  |  |
|------|-------------------|--|-------|--|--|
|      | Required Courses: |  |       |  |  |
|      | ASTR155           | Introduction to Astrophysics                         |       |  |  |
|      | ASTR210           | Fundamentals of Scientific Computing in<br>Astronomy |       |  |  |
|      | ASTR211           | Observational Astronomy                              |       |  |  |
|      | MATH121           | Calculus I   |       |  |  |
|      | MATH122           | Calculus II  |       |  |  |
|      | MATH221           | Vectors and Matrices                                 |       |  |  |

|    | PHYS113   | General Physics I   |  |  |  |  |
|----|---|---|--|--|--|--|
|    | PHYS116   | General Physics II  |  |  |  |  |
|    | PHYS213   | Waves and Oscillations                                    |  |  |  |  |
|    | PHYS214   | Quantum Mechanics I                                       |  |  |  |  |
|    | PHYS215   | Special Relativity  |  |  |  |  |
|    | Four Upper-Leve   | Astronomy Courses*:                                       |  |  |  |  |
|    | ASTR221   | Galactic Structure and Formation                          |  |  |  |  |
|    | ASTR222   | Modern Observational Techniques                           |  |  |  |  |
|    | ASTR224   | Exoplanets: Formation, Detection, and<br>Characterization |  |  |  |  |
|    | ASTR231   | Stellar Structure and Evolution                           |  |  |  |  |
|    | ASTR232   | Galaxies, Quasars, and Cosmology                          |  |  |  |  |
|    | ASTR240   | Radio Astronomy   |  |  |  |  |
| ٤L | Upper-level Astronomy course offerings may vary year-to-year. |   |  |  |  |  |

| Code |                | Title                                    | Hours |  |  |  |
|------|----------------|--|-------|--|--|--|
|      | Strongly Recom | mended Courses:                          |       |  |  |  |
|      | MATH222        | Multivariable Calculus                   |       |  |  |  |
|      | PHYS324        | Electricity and Magnetism                |       |  |  |  |
|      | PHYS219        | Introduction to Contemporary Physics (if |       |  |  |  |
|      |                | PHYS215 is not offered)                  |       |  |  |  |

Additional upper-level physics courses are also recommended but are not required. Prospective majors with graduate school aspirations should complete or place out of the basic physics and mathematics courses listed above, preferably by the end of their sophomore year, and should also take ASTR155, ASTR210, and ASTR211 during their first two years.

Since physics preparation is an important admission criterion at most astronomy graduate schools, those planning to go on for a PhD should consider a double major in physics. This can be accomplished by taking several of the following additional courses, normally in the junior and senior years: PHYS324, PHYS313, PHYS315, and PHYS316. Check the published requirements for the physics major for more details and speak to your advisor.

Additional mathematics courses, such as MATH229, may also be chosen.

Click here (https://www.wesleyan.edu/academics/journey/ Astronomy\_Advising\_Information.pdf) for more detailed information about the astronomy major, including a sample eight-semester course plan.

#### **STUDENT LEARNING GOALS**

In this major, students are expected to acquire or develop:

- a broad understanding at an introductory level of the foundational concepts and recent discoveries that have shaped modern astronomy and astrophysics
- proficiency at an advanced level with the theoretical concepts and observational tools employed in four or more distinct subfields of astrophysics
- firsthand experience with the process of science through participation in research
- the technical and research skills needed to pursue graduate study in astronomy
- analytical abilities and computing skills useful for careers outside of professional astronomy

#### **BA/MA PROGRAM**

[wesleyan.edu/grad/degree-programs/bama.html (https://www.wesleyan.edu/grad/graduate-programs/bama\_program.html)]

This program provides an attractive option for science majors to enrich their course and research background. Students are advised to begin research by their junior year if they intend to pursue the BA/MA. Admission is competitive and based on GPA, faculty recommendations, and research experience.

## **ADDITIONAL INFORMATION**

All astronomy majors are to enroll each year in the .25-credit courses ASTR430 and ASTR431. These discussion courses provide a broad exposure and introduction to research and education topics of current interest to the astronomical community. Majors are also encouraged to serve as teaching apprentices in a general education course at least once during their junior or senior year, to take part in the observing program with the department's 24-inch telescope, and to participate in the department's public outreach activities.

## HONORS

Students considering graduate school are strongly urged to do a senior thesis project (ASTR409/ASTR410); honors in astronomy requires completion of a senior thesis. Students with an interest in planetary science are advised to look at the course cluster information on that topic.

# **CAPSTONE EXPERIENCE**

Research is an integral part of an undergraduate education in astronomy, and all majors are required to complete a senior research capstone that provides experiences beyond those obtained as part of their academic coursework. The capstone, to be completed during the twelve months prior to graduation, can take several forms:

- completion of a senior thesis project
- non-thesis related astronomy research
- in-depth investigation of a current research topic, including a short written report

In all cases, students must present some aspect of their experience in a public forum, e.g., by speaking in the ASTR 431 research seminar, presenting a poster at the Wesleyan summer research program poster session, or making a presentation at a professional conference.