

ASTRONOMY, M.S.

The Department of Astronomy offers the doctor of philosophy in astronomy. Although a master's degree is offered, students are not admitted for a terminal master's degree.

The department has a long-standing reputation as one of the finest graduate astronomy and astrophysics programs in the United States. The program provides each student with a broad knowledge of modern observational and theoretical astrophysics, while emphasizing the development of independent research skills. Beginning with the first year in the program, graduate students play an active role in the department's research programs and have access to all research facilities. As teaching assistants, they also acquire experience as astronomy educators.

The faculty are engaged in a broad range of observational and theoretical research. Topics of study include dynamical phenomena of massive stars; binary star evolution; dynamics of star clusters and star forming regions; compact objects; the interstellar and intergalactic medium; star formation; plasma astrophysics; computational fluid mechanics; magnetic fields; turbulence; the structure, kinematics, and stellar populations of nearby galaxies; active galactic nuclei; galactic winds and chemical evolution; galaxy clusters; galaxy formation and evolution; the star formation and black hole accretion history of the universe; and the development of innovative astronomical instrumentation. More information is available on the department website.

RESEARCH FACILITIES

Astronomical observations at UW-Madison trace their origin to the 15-inch refractor of Washburn Observatory, founded on the campus in 1878, and still open for public viewing. Wisconsin subsequently pioneered a multi-wavelength approach to astronomical observation. Faculty, research staff, and students are frequent observers on X-ray, ultraviolet, optical, infrared, radio, and submillimeter telescopes around the globe and in space. The department currently participates in the operation of a number of research-class observing facilities and is actively engaged in the development of cutting-edge instrumentation.

The university is a major partner in the WIYN telescope, an advanced technology 3.5m telescope at Kitt Peak, Arizona, optimized for wide-field imaging and spectroscopy, and in the 11m Southern African Large Telescope (SALT), the largest single aperture optical telescope in the Southern Hemisphere. The university is also a partner in the Sloan Digital Sky Survey IV, a massive spectroscopic survey of the distant Universe, nearby galaxies, and stars in the Milky Way. The department is actively involved in ASKAP and MEERKAT, precursor experiments for an array of radio telescopes one square kilometer in size.

The department has a long history of developing astronomical instrumentation for both ground and space-based facilities. Current efforts center on the development of a near-infrared arm for the Robert Stobie Spectrograph on SALT, and the design and testing of fiber bundle arrays for the Sloan Digital Sky Survey. UW scientists are also continuing to develop and operate an innovative and highly successful Star Tracker for sounding rocket and balloon-borne experiments. Technical support is provided by in-house electronics and machine shops.

The theory group maintains a variety of facilities to support numerical simulations. The main workhorse is a 72-node, 576-core cluster optimized for tightly coupled problems, such as hydrodynamics and magneto-

hydrodynamics. A number of smaller clusters are used for development, analysis and three-dimensional visualization.

ADMISSIONS

This master's program is offered for work leading to the Ph.D. Students may not apply directly for the master's, and should instead see the admissions information for the Ph.D (<http://guide.wisc.edu/graduate/astronomy/astronomy-phd/>).

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (<https://grad.wisc.edu/funding/>) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (<http://guide.wisc.edu/graduate/#policiesandrequirements>), in addition to the program requirements listed below.

MAJOR REQUIREMENTS MODE OF INSTRUCTION

| Face to Face | Evening/ Weekend | Online | Hybrid | Accelerated |
|--------------|---------------------|--------|--------|-------------|
| Yes | No | No | No | No |

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

Evening/Weekend: Courses meet on the UW-Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

Requirement Detail

| | |
|---|---|
| Minimum Credit Requirement | 30 credits |
| Minimum Residence Credit Requirement | 16 credits |
| Minimum Graduate Coursework Requirement | 15 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) Requirement Policy: https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/) |
| Overall Graduate GPA Requirement | 3.00 GPA required. This program follows the Graduate School's policy: https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/). |
| Other Grade Requirements | A grade of S must be received in ASTRON 990 Research and Thesis before the preliminary examination may be taken. |
| Assessments and Examinations | See PhD for policy information. |
| Language Requirements | No language requirements. |

REQUIRED COURSES

| Code | Title | Credits |
|--|---|-----------|
| ASTRON 500 | Techniques of Modern Observational Astrophysics | 3 |
| ASTRON 700 | Basic Astrophysics I | 2 |
| ASTRON 702 | Basic Astrophysics II | 2 |
| ASTRON 715 | Stellar Interiors and Evolution | 2 |
| ASTRON 720 | The Interstellar Medium I: Basic Processes | 2 |
| ASTRON 730 | Galaxies | 2 |
| ASTRON 735 | Observational Cosmology | 2 |
| ASTRON/PHYSICS 910 | Seminar in Astrophysics ¹ | 0-1 |
| ASTRON 990 | Research and Thesis ² | 1-12 |
| <i>Breadth Requirement</i> | | 9 |
| See PhD policy on the Breadth Requirement for details. | | |
| Total Credits | | 30 |

¹

Barring course conflicts, students are expected to take this course every semester during their first two years for 1 credit each semester. Once students reach dissertator status, they no longer register for this course.

²

Beyond the other required courses listed, students typically take ASTRON 990 Research and Thesis credits to reach the total minimum credit requirement.

POLICIES

GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (<https://grad.wisc.edu/acadpolicy/>) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES

PRIOR COURSEWORK

Graduate Work from Other Institutions

This program follows the Graduate School's policy for Satisfying Requirements with Prior Graduate Coursework from Other Institutions. (<https://policy.wisc.edu/library/UW-1216/>)

UW-Madison Undergraduate

Up to 7 credits numbered 700 or above from a UW-Madison undergraduate degree are allowed to count toward the degree.

UW-Madison University Special

With program approval, students are allowed to count no more than 15 credits of coursework numbered 400 or above taken as a UW-Madison Special student. Coursework earned five or more years prior to admission to a master's is not allowed to satisfy requirements.

PROBATION

A grade of C or lower in a core course will result in the student being placed on academic probation. This is removed after the next grade of B or better in a core course. Grades of C or lower in two or more core courses will result in dismissal.

A semester GPA below 3.0 will result in the student being placed on academic probation. This will be removed if the student attains a GPA of 3.0 or above in the subsequent semester.

ADVISOR / COMMITTEE

All students will be assigned a mentoring committee consisting of the student's advisor and two other faculty members. Students are strongly encouraged (but not required) to meet with their mentoring committees twice a year.

CREDITS PER TERM ALLOWED

15 credits

TIME LIMITS

This program follows the Graduate School's Time Limits policy. (<https://policy.wisc.edu/library/UW-1221/>)

GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (<https://doso.students.wisc.edu/bias-or-hate-reporting/>)
- Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/#grievance-procedure>)
- Hostile and Intimidating Behavior Policies and Procedures (<https://hr.wisc.edu/hib/>)

- Office of the Provost for Faculty and Staff Affairs (<https://facstaff.provost.wisc.edu/>)
- Dean of Students Office (<https://doso.students.wisc.edu/>) (for all students to seek grievance assistance and support)
- Employee Assistance (<http://www.eao.wisc.edu/>) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (<https://employee disabilities.wisc.edu/>) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (<https://grad.wisc.edu/>) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (<https://compliance.wisc.edu/>) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office of Student Conduct and Community Standards (<https://conduct.students.wisc.edu/>) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (<http://www.ombuds.wisc.edu/>) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (<https://compliance.wisc.edu/titleix/>) (for concerns about discrimination)

Students should contact the department chair or program director with questions about grievances. They may also contact the L&S Academic Divisional Associate Deans, the L&S Associate Dean for Teaching and Learning Administration, or the L&S Director of Human Resources.

OTHER

University fellowships or departmental assistantships are offered, contingent on satisfactory progress. The length of guaranteed student support is four continuous years for those with no prior graduate work. Three continuous years of funding are guaranteed for those with one year or more of prior graduate work. It is almost always the case that students remain fully funded through their thesis defense.

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (<https://grad.wisc.edu/pd/>) to build skills, thrive academically, and launch your career.

LEARNING OUTCOMES

1. Demonstrate a broad understanding of core astrophysical topics including gravitational dynamics; radiative processes; the interstellar medium; the formation, structure, and evolution of stars and galaxies; cosmology; and observational and numerical techniques.
2. Identify sources and assemble evidence pertaining to questions or challenges in their area of concentration.
3. Synthesize knowledge from disparate sources and evaluate evidence for and against hypotheses.

4. Demonstrate academic mastery in their area of concentration, including an understanding of appropriate research methodologies, current theories, recent findings, and their broader implications.
5. Recognize and apply principles of ethical and professional conduct.

PEOPLE

Faculty:

Professors: Richard Townsend (chair), Amy Barger, Thomas Beatty, Matt Bershady, Elena D'Onghia, Catherine Grier, Sebastian Heinz, Alex Lazarian, Bob Mathieu, Michael Maseda, Snezana Stanimirovic, Christy Tremonti, Susanna Widicus Weaver, Eric Wilcots, Ke Zhang, and Ellen Zweibel

Staff:

Department Administrator: Steve Anderson
Graduate Program Manager: Heather Sauer