Twin Cities Campus

Astrophysics Ph.D.

Astrophysics, Minnesota Institute for

College of Science and Engineering

Link to a list of faculty for this program.

Contact Information:
Minnesota Institute for Astrophysics, 116 Church Street S.E., Minneapolis, MN 55455 (612-624-4811; fax: 612-626-2029)
Email: MIfA@umn.edu
Website: http://www.astro.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Fall 2020
- Length of program in credits: 64
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

Astrophysics is the study of the universe and its constituent parts. The Minnesota Institute for Astrophysics conducts research in observational, theoretical, and computational astrophysics, as well as instrument development. The main research areas include minor planetary bodies, solar system properties, dynamics of normal and active galaxies, stellar evolution, interaction of stars with their environments, the interstellar medium, astrophysical magnetohydrodynamics, and galactic and cosmological structure. Observational research includes activities that cover X-ray, ultraviolet, optical, infrared, and radio wavelengths. Extensive research programs in space physics, nucleosynthesis, and the elementary particle-cosmology interface are also carried out in interdisciplinary connections with the graduate program in physics.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.50.

Undergraduate astronomy, physics or equivalent degree required.

Other requirements to be completed before admission:
Coursework in analytical mechanics, electrodynamics, quantum mechanics, thermodynamics, and statistical physics.

Special Application Requirements:
A statement of career goals, diversity statement, scores from the GRE General Test (required) and Subject Test in physics (optional), and three letters of recommendation are required. Applications are due by December 15 to be considered for fellowships and by January 15 for teaching and research assistantships. Students are admitted fall semester only.

Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

28 credits are required in the major.
12 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.0 is required for students to remain in good standing.

Courses must be taken on the A/F grade basis, unless only offered S/N, with a minimum grade of B- earned for each course.

Major Courses (28 credits)

In consultation with adviser, select a minimum of 28 credits from the following. All students must complete PHYS 5011-12.

AST 4001 - Astrophysics I (4.0 cr)
AST 4002 - Astrophysics II (4.0 cr)
AST 4031 - Interpretation and Analysis of Astrophysical Data (4.0 cr)
AST 4041 - Computational Methods in the Physical Sciences (4.0 cr)
AST 5012 - The Interstellar Medium (4.0 cr)
AST 5022 - Relativity, Cosmology, and the Universe (4.0 cr)
AST 5201 - Methods of Experimental Astrophysics (4.0 cr)
AST 8001 - Radiative Processes in Astrophysics (4.0 cr)
AST 8011 - High Energy Astrophysics (4.0 cr)
AST 8031 - Astrophysical Fluid Dynamics (4.0 cr)
AST 8110 - Topics in Astrophysics (4.0 cr)
AST 8120 - Topics in Astrophysics (4.0 cr)
AST 8200 - Astrophysics Seminar (1.0 - 3.0 cr)
AST 8990 - Research in Astronomy and Astrophysics (1.0 - 4.0 cr)
PHYS 5011 - Classical Physics I (4.0 cr)
PHYS 5012 - Classical Physics II (4.0 cr)

Electives (12 credits)

In consultation with adviser, select a minimum of 12 credits. Additional courses may be approved by the director of graduate studies.

AEM 5501 - Continuum Mechanics (3.0 cr)
GRAD 8101 - Teaching in Higher Education (3.0 cr)
GRAD 8200 - Teaching and Learning Topics in Higher Education (1.0 cr)
MATH 5651 - Basic Theory of Probability and Statistics (4.0 cr)
PHYS 5001 - Quantum Mechanics I (4.0 cr)
PHYS 5002 - Quantum Mechanics II (4.0 cr)
PHYS 5012 - Classical Physics II (4.0 cr)
PHYS 8011 - Quantum Field Theory I (3.0 cr)
PHYS 8012 - Quantum Field Theory II (3.0 cr)
PHYS 8501 - General Relativity and Cosmology I (3.0 cr)
PHYS 8502 - General Relativity and Cosmology II (3.0 cr)
PHYS 8601 - Plasma Physics I (3.0 cr)
PHYS 8602 - Plasma Physics II (3.0 cr)
PHYS 8611 - Cosmic Rays and Plasma Astrophysics (3.0 cr)
PHYS 8801 - Nuclear Physics I (3.0 cr)
PHYS 8802 - Nuclear Physics II (3.0 cr)

Thesis Credits (24 credits)

Take 24 credits after passing preliminary oral exam.

AST 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)