ASTRONOMY, PHD

for the degree of Doctor of Philosophy in Astronomy

The Department of Astronomy offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. The goal of the graduate program in astronomy is to provide broadly based training in modern astrophysics and astronomy. Individually designed programs involving close contact with faculty members are encouraged, and an understanding of fundamental principles and techniques and their applications to research problems of current interest is emphasized. Students are expected to acquire a solid knowledge of astrophysical theory and astronomical methods. A major objective is to maintain an exciting intellectual environment in which students can develop their scientific creativity and their enthusiasm for astronomy.

Admission

Admission to the astronomy graduate program requires an outstanding record of accomplishment and clear evidence of considerable academic promise, as judged by undergraduate transcripts, resume (or c.v.), letters of recommendation, personal statement, and strong intellectual achievements. A bachelor's degree or its equivalent in astronomy, physics, chemistry, mathematics, or another related technical field from an accredited college or university in the U.S. or an approved institution of higher learning abroad is required for admission.

A minimum grade point average of 3.0 (A = 4.0) is required for admission. Course preparation in intermediate and advanced undergraduate physics and astronomy are essential. Students are expected to make up deficiencies during the first graduate year.

All applicants whose native language is not English are required to submit the results of the TOEFL or IELTS as evidence of English proficiency, as required by Graduate College policy. More information on the English Proficiency Requirement can be found at the Graduate College Admissions website (http://www.grad.illinois.edu/admissions/instructions/04c/).

Admission decisions are normally made once a year in the spring. Applications for admission and financial assistance must be received by January 15. In rare circumstances, applicants may be admitted for the spring semester, in addition to the customary fall semester admissions.

See the Astronomy graduate admissions website (https://astro.illinois.edu/admissions/graduate-applications-and-admissions/) for more information and application materials.

Graduate Teaching Experience

Although teaching is not a general Graduate College requirement, experience in teaching is considered an important part of the graduate experience in this program.

Faculty Research Interests

Research activity in the Department of Astronomy includes observational and theoretical investigations across a vast range of size scales and spanning the full history of the universe. Use of emerging techniques including time-domain and multi-messenger astronomy and machine learning are strongly encouraged. Research areas include:

- Early-universe cosmology and the large-scale structure of the universe, including the cosmic microwave background, galaxy formation, and galaxy clusters;
- Extragalactic astronomy, including galaxy structure and evolution, active galaxies, supermassive black holes, and the regulation and quenching of star formation;
- Theory and observations of the interstellar medium, including molecular clouds, HII regions, and the role of magnetic fields in star formation;
- Star formation and stellar evolution, including protoplanetary disks, binary systems, supernovae, and nucleosynthesis;
- Exoplanetary systems and their evolution; and
- Compact objects (black holes, neutron stars, white dwarfs) and gravitational wave sources.

In addition, faculty in the Department of Astronomy and the Department of Physics have long-standing expertise in modeling relativistic systems, and faculty in the Physics Department can supervise student research.

Facilities and Resources

- Sloan Digital Sky Survey V
- South Pole Telescope
- Subaru Prime Focus Spectrograph
- Astronomy students and faculty successfully compete for time on national facilities. These include ground-based telescopes of the National Radio Astronomy Observatory, such as the Atacama Large Millimeter Telescope and the Very Large Array, and the National Optical Astronomy Observatory telescopes. Illinois research involves many space-based telescopes, including the Hubble and Webb Space Telescopes and the Chandra X-ray Observatory.
- A number of projects in the Department of Astronomy partner with the National Center for Supercomputing Applications (NCSA) at Illinois. Such projects often require high-performance computing or leverage NCSA's pioneering development of cyberinfrastructure environments.
- Faculty from NCSA, and Astronomy and Physics Departments are also involved in the Center for Astrophysical Surveys (CAPS), applying novel algorithms to the rich large datasets from several major projects including the Sloan Digital Sky Survey (SDSS), the Dark Energy Survey(DES), the Young Supernova Experiment (YSE), the Laser Interferometric Gravitational Wave Observatory (LIGO), the Vera Rubin Observatory (VRO), and the South Pole Telescope (SPT).

Financial Aid

University fellowships are available and may be combined with part-time teaching assistantships. Most students are supported by half-time teaching or research assistantships. More information is available from the Astronomy Department website (https://astro.illinois.edu/admissions/graduate/financial-aid/).

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For additional details and requirements refer to the department's Graduate Programs (http://www.astro.illinois.edu/academics/graduate/programs/) and the Graduate College Handbook (http://www.grad.illinois.edu/gradhandbook/).

Astronomy, PhD

Entering with approved M.A./M.S. degree

Code	Title	Hours
ASTR 501 & ASTR 502	Radiative Processes and Astrophysical Dynamics	8
	Students entering with an approved M.A. or M.S. degree may proficiency out of these with departmental approval. Other 500-level ASTR graduate courses must be taken in the unit for substitute credit hours.	
Demonstrated Proficiency in Astronomy: A maximum of 8 hours of these courses may be applied to the degree (See details below.)		8
Research/Project/Independent Study Hours (e.g. ASTR 590 min/max applied toward degree):		4-24
ASTR 599	Thesis Research (min/max applied toward degree)	32-52
Total Hours		**64**

Other Requirements

Requirement	Description
Other requirements may overlap	
Students may add a graduate concentration in Astrochemistry.	
Qualifying Exam Required	No
Preliminary Exam Required	Yes
Final Exam/Dissertation Defense Required	Yes
Dissertation Deposit Required	Yes
Minimum GPA:	3.0
Demonstrated Proficiency in Astronomy: Students must show proficiency in ASTR 404, ASTR 405, ASTR 406 and ASTR 414 by one of the following options:	
-Pass the appropriate section of the placement exam (four sections aligned to the four courses), which is offered at the start of every Fall semester. A student can petition to take the exam once more the following year. The decision on petition approval by the graduate advisor will depend on the student's background and proficiency plan.	
-Pass the course with a B grade or better.	
-Students who have had an equivalent course at another institution (B grade or better) may petition for those courses to count as proficiency.	

Entering with approved B.A./B.S. degree

Code	Title	Hours
ASTR 501 & ASTR 502	Radiative Processes and Astrophysical Dynamics	8
Demonstrated Proficiency in Astronomy: A maximum of 8 hours of these courses may be applied to the degree (See details below.)		8
Additional formal coursework (excluding thesis research, non-thesis research and independent study credit hours, e.g., ASTR 599, ASTR 590) [3,4]		24
	Of the additional formal coursework, 8 is the minimum number of hours in the unit (excluding thesis research, non-thesis research, and independent study credit hours)	
	Of the additional formal coursework, 8 (with 4 in the unit) is the minimum number of 500-level hours (excluding thesis research, non-thesis research, and independent study credit hours)	
Research/Project/Independent Study Hours (e.g. ASTR 590 min/max applied toward degree):		4-32
ASTR 599	Thesis Research (min/max applied toward degree)	32-60
Total Hours		**96**

Other Requirements

Requirement	Description
Other requirements may overlap	
Demonstrated Proficiency in Astronomy: In the first year students must show proficiency in ASTR 404, ASTR 405, ASTR 406 and ASTR 414 by one of the following options:	
-Pass the appropriate section of the placement exam (four sections aligned to the four courses), which is offered at the start of every Fall semester. A student can petition to take the exam once more the following year. The decision on petition approval by the graduate advisor will depend on the student's background and proficiency plan.	
-Pass the course with a B grade or better.	
-Students who have had an equivalent course at another institution (B grade or better) may petition for those courses to count as proficiency.	
Students may add a graduate concentration in Astrochemistry.	
First Summer Research Project (4 hours)	During the first summer in residence, each student will enroll in ASTR 590 (independent Study) and will complete a research project with an Astronomy Department faculty member. A paper reporting the results is required, which must be prepared in scientific journal style and approved by the faculty member.
Master's Degree Required Before Admission to PhD?	No
Qualifying Exam Required	No

Preliminary Exam Required	Ph.D. Preliminary Examination consists of a written preliminary paper on the Ph.D. research topic and an oral examination. It must be passed by the end of the third year of study.
Final Exam/Dissertation Defense Required	Completion of an original research project culminating in a dissertation thesis publishable in whole or in part is required. The final examination is a defense of the doctoral dissertation.
Dissertation Deposit Required	Yes
Minimum GPA:	3.0

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1. Infer and characterize the physical mechanisms that govern the observable properties of the Universe and its constituents, including galaxies, stars, and planets, as well as the changes in those properties over time.
2. Understand how the observational, statistical, and computational methods of modern astronomy are used to generate the scientific knowledge referred to in LO1.
3. Plan and perform original research in astronomy and astrophysics.
4. Effectively communicate astronomy knowledge and research results in both oral and written form to a variety of audiences.
5. Demonstrate the ability to formulate and write a research proposal.

Graduate Degree Programs in Astronomy

- Astronomy, MS (http://catalog.illinois.edu/graduate/las/astronomy-ms/)
- Astronomy, PhD (p. 1)

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Astronomy Department

Chair of the Department: Tony Wong
Director of Graduate Studies: Brian Fields
Astronomy Department website (https://astro.illinois.edu/)
103 Astronomy Building, 1002 West Green Street, Urbana, IL 61801
(217) 333-3090
astronomy@illinois.edu

College of Liberal Arts & Sciences

College of Liberal Arts & Sciences website (https://las.illinois.edu/)

Admissions

Astronomy Graduate Admissions (https://astro.illinois.edu/admissions/graduate-applications-and-admissions/)
Graduate College Admissions & Requirements (https://grad.illinois.edu/admissions/apply/)