



**University Graduate School  
2007-2008  
Academic Bulletin**

**Astrophysics**

College of Arts and Sciences  
Bloomington

**Chairperson**

Professor Stuart L. Mufson\*

**Departmental E-Mail**

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**Departmental URL**

[www.astro.indiana.edu](http://www.astro.indiana.edu)

**Interdepartmental Graduate Committee on Astrophysics**

(An asterisk [\*] denotes membership in the University Graduate School faculty with the endorsement to direct doctoral dissertations.)

**Professors**

Stuart L. Mufson\* (Astronomy), Professors Andrew Bacher\* (Physics), Haldan Cohn\* (Astronomy), Richard H. Durisen\* (Astronomy), Alan Kostelecky\* (Physics)

**Senior Scientist**

Charles Bower\* (Physics)

**Academic Advisor**

Professor Richard H. Durisen\*, Swain Hall West 319, (812) 855-6921

**Degree Offered**

Doctor of Philosophy

The astrophysics program is administered jointly by the Department of Astronomy and the Department of Physics through the interdepartmental committee named above. Interested students must first gain admission to one of these departments and then petition the committee for entrance into the program after establishing departmental residency. Students may qualify for a master's degree in astronomy or physics while in this program. Doctoral dissertations in astrophysics may be directed by any qualified member of the Department of Astronomy or Physics graduate faculty.

**Special Program Requirements**

(See also [general University Graduate School requirements](#).)

**Admission Requirements**

A student should have the combined admission requirements of doctoral students in astronomy and physics; i.e., a thorough undergraduate training in physics and mathematics plus familiarity with general astronomy at the level of A221-A222 or, preferably, A451-A452. Deficiencies must be removed early, usually without graduate credit.

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## Course Requirements

A total of 90 credit hours, including the following courses or their equivalents: Physics P506, P511, P521, and P556; four courses from among Astronomy A505, A520, A540, A550, A570, A575, and A580; one course from among P507, P512, P637, G630, and G650 or a fifth astronomy core course; and dissertation.

## Minor

By meeting the course requirements for this degree, a student from the Department of Astronomy will automatically fulfill the requirements for a minor in physics, and a student from the Department of Physics will automatically fulfill the requirements for a minor in astronomy.

## Foreign Language/Research-Skill Requirement

A student in the astrophysics program must meet the foreign language/research-skill requirements (if any) of the department of residence.

## Grades

Grades below B (3.0) in astronomy and physics courses may be counted toward degree requirements only with the consent of the astrophysics committee.

## Qualifying Examination

A student must pass specially designated parts of the qualifying examinations of both departments—specifically, half of the physics qualifying examination, which emphasizes classical mechanics, electromagnetism, and statistical physics—plus part of the astronomy qualifying examination. For the astronomy qualifier, the student is required to answer the one general astronomy question and 6 of the remaining 14 questions. The examination requirements must be satisfied by the end of the student's sixth semester in residence. The department of residence may also specify its own deadline for passage of the examination it administers.

## Final Examination

Oral defense of dissertation.

## Courses

### Graduate

**G630 Nuclear Astrophysics (3 cr.)** P: A451, P453-P454, or consent of instructor. R: A550, P511. Applications of nuclear physics to astronomy. Fundamental properties of nuclei and nuclear reactions. Element synthesis and energy generation in the big bang, stellar interiors, and supernovae. Discussion of current topics: cosmological nucleosynthesis, solar neutrino flux, explosive nucleosynthesis, high-energy nuclear processes.

**G650 High-Energy Astrophysics (3 cr.)** Covers cosmic rays from the perspective of astrophysics and high-energy particle physics. Examples of topics that may be included are the production, propagation, and interactions of cosmic rays as well as the experimental detection of cosmic rays. Subtopics include atmospheric and solar neutrinos, magnetic monopoles, point sources of cosmic rays, neutrino oscillations, air showers, and stellar collapse detection.

**G750 Topics in Astrophysical Sciences (1-3 cr.)** A seminar in astrophysics with special emphasis on subjects involving more than one department. Examples of such topics include planetology, nucleosynthesis, nuclear cosmochronology, isotopic anomalies in meteorites, particle physics of the early universe, and atomic processes in astrophysical systems.