Astronomy and Astrophysics

Astronomy and astrophysics is the study of planets, stars, galaxies and the universe as a whole, including how these originate and how they evolve in time. The principal pursuits of the astronomer are to extend our understanding of the physical nature of the universe and to convey this understanding to students and the general public.

Astronomy and astrophysics are observational, not experimental, sciences. With only a few exceptions (e.g., meteorites, moon rocks and comet samples), astronomers cannot actually handle celestial objects and are totally dependent upon incoming radiation from space. Observations over the entire electromagnetic spectrum (gamma rays, x-rays, ultraviolet, visible light, infrared, microwave and radio waves) are collected with both earth-based and space telescopes. These observations are then analyzed and interpreted using the tools of modern theoretical physics. The heart of the prospective astronomer’s education therefore consists of a firm grounding in physics and the advanced mathematics at the core of physics.

Pursuing Astronomy and Astrophysics at Ohio State

Students who major in astronomy and astrophysics should be ready to start their calculus and physics courses as soon as they begin college. This means that their high school mathematics should go up to and include analytical geometry and trigonometry, and their high school science courses should include physics and chemistry. Experience with computers is also very helpful.

Students may declare astronomy and astrophysics as their major and register as students in the College of Arts and Sciences at the Arts and Sciences Office in Denney Hall. For additional information, students are encouraged to visit the Department of Astronomy on the fourth floor of McPherson Lab.

Program Educational Objectives

- Provide students with the opportunity to master the fundamental physics at the heart of modern astrophysics: classical mechanics, electromagnetism, quantum mechanics and thermodynamics.
- Help students to develop problem-solving skills and the ability to analyze physical systems within the framework of theoretical physics.
- Provide students with an overview of research topics in contemporary astronomy.
- Provide students with a basic mastery of data analysis and statistics.
- Teach students to communicate effectively both orally and in writing.
- Provide students with the opportunity to develop a basic knowledge of and facility with computing.

Astronomy and Astrophysics Requirements

Modern astronomy is essentially physics applied to the study of celestial objects. Therefore, the astronomy and astrophysics major curriculum looks very much like the physics major curriculum, although certain advanced physics courses and laboratories are not included for an astronomy and astrophysics degree. In addition, students who major in astronomy and astrophysics are required to take an introductory sequence in astrophysics plus an advanced course and an observational techniques and data analysis course.

Co-Curricular Opportunities

The Astronomy Department encourages all of its majors to pursue research with one of its faculty members in one of many active research programs. This is an excellent opportunity to learn about and become involved in the cutting edge of astronomy discoveries. Areas of research include extrasolar planets, quasars, cosmology, dark matter, stellar structure, instrumentation, and galaxy evolution.

Honors & Scholars Opportunities

Ohio State offers the Honors and Scholars Programs to create an environment of intellectual support and stimulation within a close-knit community of high-ability undergraduate students. Through these programs, students have access to smaller classes, undergraduate research opportunities, close working relationships with faculty, priority scheduling, and unique housing options.

The Honors and Scholars Programs represent great opportunities to be part of a smaller community within a large university. Learn more at honors-scholars.osu.edu.

Career Prospects in Astronomy and Astrophysics

Most professional astronomers have faculty positions at universities and colleges or are affiliated with universities and colleges through observatories and laboratories. For these astronomers, teaching and research are the major areas of activity. A PhD is generally required for faculty positions. Some professional astronomers are employed by the federal government directly (e.g., NASA) or by federally supported national observatories and laboratories (e.g., the National Optical Astronomy Observatories and the National Radio Astronomy Observatory). Others find employment in the aerospace industry or with companies involved in computation or image processing. A PhD in astronomy or physics is also generally required for these positions.

For more information, check these web sites:

Astronomy: astronomy.osu.edu
College of Arts and Sciences: artsandsciences.osu.edu
Ohio State: osu.edu
Admissions: undergrad.osu.edu
First Year Experience Programs: fye.osu.edu
Multicultural Center: multiculturalcenter.osu.edu
Individuals with an MS and/or a BS in Astronomy and Astrophysics may find opportunities to teach at the high school level. They may also find employment at observatories, planetariums, science museums, and in industry where they may assist in computational and observational research programs or participate in public education programs.

A BS in Astronomy and Astrophysics is excellent preparation for graduate study in astronomy and in some other physical sciences. The critical thinking, problem solving and intellectual rigor of this program may also be valuable preparation for a variety of other challenging careers in such diverse fields as law, business and computer programming.

Beginning salaries for faculty positions at colleges and universities range from $50,000 to $80,000, depending upon the candidate’s skills, previous experience (generally gained in postdoctoral research positions), and the size, quality and competitiveness of the school.

Career Counseling and Job Placement
Ohio State’s professional counseling staff specializes in personal development and academic growth. In addition, Ohio State’s career and job placement offices around campus offer help in career planning and, as students move closer to graduation, resume and application letter writing and job placement. These offices can help students match interests and strengths with a promising career. Ohio State recognizes that students’ needs for career support services vary and offers special services for disabled students, veterans, minority students and international students.

Curriculum Sample
This is a sample list of classes a student will take to pursue a degree in Astronomy and Astrophysics. Since university students need more than specific education in a narrow field, they also will take classes to complete General Education (GE) requirements. Because GE courses come from a variety of academic areas of study, this course work helps students develop fundamental skills essential to collegiate success and allows them to tailor these courses toward their interests. Note: This sample represents one of several possible paths to a degree in Astronomy and Astrophysics, and not all of the courses listed below are required. Consult the departmental website, astronomy.osu.edu, for details on each specific track.

Freshman Year:
Astronomy and Astrophysics Seminar 1
Arts and Sciences Survey 1
Calculus I and II 10
Physics I and II 10
Introduction to C++ 3
GE courses 9
Total hours 34

Sophomore Year:
Basic Astrophysics and Planetary Astronomy 3
Stellar, Galactic, and Extragalactic Astronomy and Astrophysics 3
Calculus III 4
Ordinary and Partial Differential Equations 3
Linear Algebra 3
Dynamics of Particles and Waves I and II 8
Physics Data Analysis Lab 3
GE courses 6
Total hours 33

Junior Year:
Methods of Astronomical Observations and Data Analysis 3
Stellar Evolution or Cosmology 3
Quantum Physics I and II 8
Electricity and Magnetism I and II 8
Vector Analysis 3
GE courses 9
Total hours 34

Senior Year:
Stellar Evolution or Cosmology 3
Statistical Physics 4
GE courses 16
Senior Thesis or electives 9
Total hours 32

Revised November 2011. For the most up-to-date information on the astronomy and astrophysics program, please visit astronomy.osu.edu.