ASTRONOMY AND ASTROPHYSICS, B.S.

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description

Astronomy involves the study of the properties, physical nature and origins of the planets, stars, galaxies and universe as a whole. It involves development of instrumentation, observations of celestial objects with ground- and space-based telescopes, and interpretation of findings using the mathematical laws of physics such as gravity, electromagnetism and quantum mechanics. The undergraduate major provides a strong and broad foundation in mathematics, physical science and computation as well as a detailed understanding of modern astronomy. Many research opportunities are available to complement the formal classwork. Graduates proceed to advanced degrees in astronomy and other sciences, and into a wide variety of technical professions.

What is Astronomy and Astrophysics?

Astronomy and Astrophysics is the study of the fundamental problems of the nature and evolution of our Universe. Astronomy and Astrophysics includes topics ranging from the most distant and powerful objects in the universe, quasars and gamma ray bursts, to the origins of chemical elements in stars, to planets, both in our solar system and in orbit around other stars.

You Might Like This Program If...

- You enjoy applying the ideas of physics to the study of complex systems and phenomena found beyond the Earth.
- You want to study the answers to big questions relating to astronomy, such as 'how was the universe created?' and 'how likely is it that life exists outside the Earth?'
- You enjoy writing computer software to solve problems.
- You have an interest in computer image processing and analysis.

Entrance to Major

In order to be eligible for entrance to the Astronomy and Astrophysics major, a student must have:

1. Attained at least a 2.00 cumulative grade-point average.
2. Completed and earned a grade of C or better in each of the following courses: ASTRO 291, CHEM 110, MATH 140, MATH 141, PHYS 211, and PHYS 212.

Degree Requirements

For the Bachelor of Science degree in Astronomy and Astrophysics, a minimum of 125 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	98

18 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GWS courses.

Requirements for the Major

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/).

Common Requirements for the Major (All Options)

Code	Title	Credits
Prescribed Courses		
ASTRO 320	Observational Astronomy Laboratory	3
CHEM 111	Experimental Chemistry I	1
CHEM 112	Chemical Principles II	3
ENGL 202C	Effective Writing: Technical Writing	3
MATH 230	Calculus and Vector Analysis	4
MATH 251	Ordinary and Partial Differential Equations	4
PHYS 237	Introduction to Modern Physics	3
Prescribed Courses: Require a grade of C or better		
ASTRO 291	Astronomical Methods and the Solar System	3
ASTRO 292	Astronomy of the Distant Universe	3
CHEM 110	Chemical Principles I	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4
PHYS 213	General Physics: Fluids and Thermal Physics	2
PHYS 214	General Physics: Wave Motion and Quantum Physics	2
Additional Courses		
Select one of the following:		3
CMPSC 121	Introduction to Programming Techniques	
CMPSC 201	Programming for Engineers with C++	
CMPSC 202		
Supporting Courses and Related Areas		
Supporting Courses and Related Areas: Require a grade of C or better		
Select 12 credits from 400-level ASTRO courses [1]		12
Requirements for the Option		
Select an option		34

[1] Except ASTRO 401, ASTRO 402W, ASTRO 494H, and ASTRO 496.

Requirements for the Option

Graduate Study Option (33 credits)

Code	Title	Credits
Prescribed Courses		
PHYS 400	Intermediate Electricity and Magnetism	3
PHYS 410	Introduction to Quantum Mechanics I	3-4
PHYS 419	Theoretical Mechanics	3
Additional Courses		
Select one of the following:		3
MATH 405	Advanced Calculus for Engineers and Scientists I	
MATH 411	Ordinary Differential Equations	
MATH 417	Qualitative Theory of Differential Equations	
Select 6-7 credits of the following:		6-7

EE 471/ AERSP 490/ NUCE 490	Introduction to Plasmas	
PHYS 402	Electronics for Scientists	
PHYS 406	Subatomic Physics	
PHYS 411	Introduction to Quantum Mechanics II	
PHYS 420	Thermal Physics	
PHYS 457		
PHYS 457W	Experimental Physics	
PHYS 458	Intermediate Optics	
PHYS 479	Special and General Relativity	
Supporting Courses and Related Areas		
Select 3 additional credits from advanced courses in computer science and engineering, mathematics, or statistics		3
Select 10-11 credits in consultation with adviser from department list		10-11

Computer Science Option (33 credits)

Code	Title	Credits
Prescribed Courses		
CMPSC 122	Intermediate Programming	3
CMPSC 221	Object Oriented Programming with Web-Based Applications	3
CMPSC 451	Numerical Computations	3
Additional Courses		
Select one of the following:		3
STAT 318	Elementary Probability	
STAT 319	Elementary Mathematical Statistics	
STAT 401	Experimental Methods	
STAT 414	Introduction to Probability Theory	
Select two of the following:		6
CMPEN 271	Introduction to Digital Systems	
CMPEN 331	Computer Organization And Design	
CMPSC 360	Discrete Mathematics for Computer Science	
CMPSC 465	Data Structures and Algorithms	
Supporting Courses and Related Areas		
Select 3 additional credits from advanced courses in computer science and engineering, mathematics, or statistics		3
Select 12 credits in consultation with adviser from department list		12

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration

- **GN,** may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher**:** 6 credits

University Degree Requirements

First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or

within time constraints (see Senate Policy 83-80 (https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/)). For more information, check the Suggested Academic Plan for your intended program.

Program Learning Objectives

- Accurately apply mathematical tools to real physical problems.
- Use sophisticated and varying techniques in problem solving.
- Explain the physical meaning of mathematical expressions and operations used in quantitative problem solving.
- Clearly communicate both technical and descriptive content while following the conventions of scientific writing.
- Distinguish between scientific theories and other kinds of (non scientific) explanations.
- collect and analyze real astronomical data.
- Give clear oral presentations of technical material.
- Write original computer code to accomplish a computational task, such as analyzing data, displaying astronomical images, or performing calculations.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/32-00-advising-policy/)

University Park

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2025-26 academic year. To access previous years' suggested academic plans, please visit the archive (https://bulletins.psu.edu/undergraduate/archive/) to view the appropriate Undergraduate Bulletin edition.

Computer Science Option: Astronomy and Astrophysics, B.S. at University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits	Spring	Credits
ASTRO 20	2	ENGL 15, 30H, or ESL 15[‡]	3
MATH 140[*‡#†]	4	MATH 141[*‡#†]	4
CHEM 110[*#†]	3	CHEM 111[†]	1
PHYS 211[*#†]	4	CHEM 112	3
General Education Course	3	PHYS 212[*#†]	4
		General Education Course (GHW)	1.5
	16		**16.5**

Second Year

Fall	Credits	Spring	Credits
ASTRO 291[*#]	3	ASTRO 292[*]	3
MATH 230	4	MATH 251	4
PHYS 213[*]	2	PHYS 237	3
PHYS 214[*]	2	CMPSC 121, 201, or 202[†]	3
CAS 100, CAS 100A, CAS 100B, or CAS 100C[‡]	3	General Education Course	3
	14		**16**

Third Year

Fall	Credits	Spring	Credits
ASTRO 320	3	ASTRO 400 level selection (consult with an academic adviser for options)[*]	3
ASTRO 400 level selection (consult with an academic adviser for options)[*]	3	CMPSC 221	3
CMPSC 122	3	CMPSC 360 or CMPEN 271	3
STAT 300 or 400 level selection (consult with an academic adviser for options)	3	ENGL 202C[‡†]	3
General Education Course	3	General Education Course	3
General Education Course (GHW)	1.5		
	16.5		**15**

Fourth Year

Fall	Credits	Spring	Credits
ASTRO 400 level selection (consult with an academic adviser for options)[*]	3	ASTRO 400 level selection (consult with an academic adviser for options)[*]	3
CMPSC 451 or MATH 451	3	CMPSC/CMPEN 400 Level selection (consult with an academic adviser for options)	3
CMPSC 465 or CMPEN 331	3	Supporting Course (consult with an academic adviser for options)	3

Supporting Course (consult with an academic adviser for options)	1	Supporting Course (consult with an academic adviser for options)	3
General Education Course	3	Supporting Course (consult with an academic adviser for options)	3
General Education Course	3		
	16		**15**

Total Credits 125

* Course requires a grade of C or better for the major
‡ Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
† Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

All incoming Schreyer Honors College first-year students at University Park will take ENGL 137H/CAS 137H in the fall semester and ENGL 138T/CAS 138T in the spring semester. These courses carry the GWS designation and satisfy a portion of that General Education requirement. If the student's program prescribes GWS these courses will replace both ENGL 15/ENGL 30H and CAS 100A/CAS 100B/CAS 100C. Each course is 3 credits.

Graduate Studies Option: Astronomy and Astrophysics, B.S. at University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits	Spring	Credits
ASTRO 20	2	ENGL 15, 30H, or ESL 15‡	3
MATH 140*‡#†	4	MATH 141*‡#†	4
CHEM 110*‡#†	3	CHEM 111†	1
PHYS 211*‡#†	4	CHEM 112†	3
General Education Course	3	PHYS 212*‡#†	4
		General Education Course (GHW)	1.5
	16		**16.5**

Second Year

Fall	Credits	Spring	Credits
ASTRO 291*#	3	ASTRO 292*	3
MATH 230	4	MATH 251	4
PHYS 213*	2	PHYS 237	3
PHYS 214*	2	CMPSC 121, 201, or 202	3
CAS 100, CAS 100A, CAS 100B, or CAS 100C‡	3	General Education Course	3
	14		**16**

Third Year

Fall	Credits	Spring	Credits
ASTRO 320	3	ASTRO 400 level selection (consult with an academic adviser for options)*	3
ASTRO 400 level selection (consult with an academic adviser for options)*	3	PHYS 400	4
MATH 405, 411, or 417	3	CMPSC/MATH/STAT selection (consult with an academic adviser for options)	3
PHYS 419 or MATH 419	3	ENGL 202C‡†	3
General Education Course	3	General Education Course	3
General Education Course (GHW)	1.5		
	16.5		**16**

Fourth Year

Fall	Credits	Spring	Credits
ASTRO 400 level selection (consult with an academic adviser for options)*	3	ASTRO 400 level selection (consult with an academic adviser for options)*	3
PHYS 410	4	PHYS 400 level selection (consult with an academic adviser for options)*	3
PHYS 400 level selection (consult with an academic adviser for options)*	3	Supporting Course (consult with an academic adviser for options)	3
General Education Course	3	Supporting Course (consult with an academic adviser for options)	3
General Education Course	3	Supporting Course (consult with an academic adviser for options)	2
	16		**14**

Total Credits 125

* Course requires a grade of C or better for the major
‡ Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
† Course satisfies General Education and degree requirement

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Career Paths

Careers

Penn State students with a B.S. in Astronomy & Astrophysics have been successful in establishing careers in a wide variety of technical fields. Students should be aware that a degree in astronomy is less well known by employers than degrees in computer science or physics. We encourage majors intending to end their education with a B.S. to obtain a minor or double major in one of these two allied fields. Students interested in job placement after a B.S. degree are strongly encouraged to participate in departmental research or the Eberly College of Science internship program during their time at Penn State.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE ASTRONOMY AND ASTROPHYSICS PROGRAM (https://science.psu.edu/astro/undergrad/career-opportunities/)

Opportunities for Graduate Studies

Many of our alumni pursue graduate education in astrophysics after completing our undergraduate degree. Students apply to enter PhD programs in astrophysics in the fall of their senior year. Some students choose to do graduate work in related fields such as physics, geoscience / planetary science, ecology, or engineering. Other students have successfully pursued master's degrees in education in order to earn teaching certification to teach physics or Earth and space science.

Professional Resources

- American Astronomical Society (https://aas.org)
- Astronomical Society of the Pacific (https://astrosociety.org)

Contact

University Park

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