

# PLANETARY SCIENCE AND ASTRONOMY, B.S.

**Begin Campus:** Any Penn State Campus

**End Campus:** University Park

## Program Description

Planetary Science and Astronomy majors will study the Earth system in the context of the Solar System and the universe as a whole. Students will apply methods and knowledge from mathematics, geosciences, chemistry, biology, astronomy and physics, and through laboratory experiences and coursework they will both learn to explore the Earth and to use telescopes to obtain astronomical data. They will study planetary systems around other stars and explore the possibility of their harboring life. Communication of these topics, both oral and written, to the public and to their peers will be emphasized, as will logic and general problem-solving skills. Upon graduation students will be prepared to enter a graduate program in education to obtain teaching certification, to work in an informal science venue or planetarium, or to enter a variety of industry, environmental, or defense professions.

## What is Planetary Science and Astronomy?

Planetary Science and Astronomy is the study of the Earth system in the context of the Solar System and the universe as a whole. Students will apply methods and knowledge from mathematics, geosciences, chemistry, biology, astronomy and physics, and through laboratory experiences and coursework they will learn to both explore the Earth and to use telescopes to obtain astronomical data. Students interested in science education will likely seek a graduate program that will provide a teaching certificate.

### You Might Like This Program If...

- Your interest in science combines Earth systems science and studying the Universe beyond the Earth.
- You want to go deeper into questions about black holes, life in the Universe, and the origin of the Universe.
- You have an interest in science communication or science education.

## Entrance to Major

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

1. Attained at least a 2.00 cumulative grade-point average;
2. Completed MATH 140 with a grade of C or better;
3. Completed at least four of the following courses with a grade of C or better: ASTRO 120, ASTRO 130, ASTRO 140, BIOL 110, CHEM 110, EARTH 2, GEOSC 1, GEOSC 20, or STAT 200.

## Degree Requirements

**For the Bachelor of Science degree in Planetary Science and Astronomy, a minimum of 122 credits is required:**

Requirement	Credits
General Education	45
Requirements for the Major	95-99

**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/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
<b>Prescribed Courses</b>		
CHEM 111	Experimental Chemistry I	1
CHEM 113	Experimental Chemistry II	1
ENGL 202C	Effective Writing: Technical Writing	3
MATH 141	Calculus with Analytic Geometry II	4
<i>Prescribed Courses: Require a grade of C or better</i>		
ASTRO 401	Fundamentals of Planetary Science and Astronomy	4
ASTRO 402W	Astronomical Telescopes, Techniques, and Data Analysis	3
BIOL 110	Biology: Basic Concepts and Biodiversity	4
BIOL/GEOSC 474	Astrobiology	3
CHEM 110	Chemical Principles I	3
CHEM 112	Chemical Principles II	3
MATH 140	Calculus With Analytic Geometry I	4
STAT 200	Elementary Statistics	4
<b>Additional Courses</b>		
PHYS 211	General Physics: Mechanics	4
or PHYS 250	Introductory Physics I	
PHYS 212	General Physics: Electricity and Magnetism	4
or PHYS 251	Introductory Physics II	
Select one of the following:		3
ASTRO 1	Astronomical Universe	
ASTRO 5	The Sky and Planets	
ASTRO 6	Stars, Galaxies, and the Universe	
ASTRO 291	Astronomical Methods and the Solar System	
Select one of the following:		3-4
CMPSC 101	Introduction to Programming	
CMPSC 121	Introduction to Programming Techniques	
CMPSC 201	Programming for Engineers with C++	
CMPSC 202		
CMPSC 203	Introduction to Spreadsheets and Databases	
Select three of the following:		9
ASTRO 120	The Big Bang Universe	
ASTRO 130	Black Holes in the Universe	
ASTRO 140	Life in the Universe	
ASTRO 292	Astronomy of the Distant Universe	
Select one of the following:		3
EARTH 2	The Earth System and Global Change	

GEOSC 1	Physical Geology	
GEOSC 20	Planet Earth	
Select 12 credits of the following:		12
EARTH 100	Environment Earth	
EARTH 103N	Earth in the Future: Predicting Climate Change and Its Impacts Over the Next Century	
EARTH 106		
EARTH 150	Dinosaur Extinctions and Other Controversies	
EARTH 402	Modeling the Earth System	
GEOG 160	Mapping Our Changing World	
GEOSC 201	Earth Materials	
GEOSC 202	Chemical Processes in Geology	
GEOSC 203	Physical Processes in Geology	
GEOSC 204	Geobiology	
METEO 101	Understanding Weather Forecasting	
METEO 201	Introduction to Weather Analysis	

### Supporting Courses and Related Areas <sup>1</sup>

Select 11 credits in consultation with adviser from department list	11
Select 9-12 credits from program list of advanced electives	9-12

<sup>1</sup> At least 6 credits from the below categories must be at the 400 level.

## 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/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

## Program Learning Objectives

Accurately apply mathematical tools to real physical problems.  
Describe how the techniques and principles from biology, chemistry, physics, geoscience, and meteorology are used to study planets and planetary systems.  
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.  
Set up and use a small telescope for night sky observing in an education or outreach setting with non-experts.

## 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/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 2023-24 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 (*Note: the archive only contains suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

## Planetary Science and Astronomy, 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	CHEM 110 <sup>*†##</sup>	3
MATH 140 <sup>*†##</sup>	4	CHEM 111 <sup>†</sup>	1
ASTRO 1, 5, or 6	3	MATH 141 <sup>††</sup>	4
GEOSC 1 <sup>*†##</sup>	3	ASTRO 120 or 130 <sup>*†##</sup>	3
General Education Course	3	ENGL 15, 30H, or ESL 15 <sup>†</sup>	3
	<b>15</b>		<b>14</b>

### Second Year

Fall	Credits	Spring	Credits
BIOL 110 <sup>*†##</sup>	4	CAS 100, CAS 100A, CAS 100B, or CAS 100C <sup>‡</sup>	3
CHEM 112 <sup>*†</sup>	3	CMPSC 201	3
CHEM 113 <sup>†</sup>	1	EARTH 103N (consult with an academic adviser for alternative options)	3
PHYS 211 or 250	4	General Education Course	3
ASTRO 140 <sup>*†##</sup>	3	STAT 200 <sup>*#</sup>	4
	<b>15</b>		<b>16</b>

### Third Year

Fall	Credits	Spring	Credits
ASTRO 401 <sup>*</sup>	4	ASTRO 402W <sup>*</sup>	3
ENGL 202C <sup>††</sup>	3	PHYS 212 or 251	4
EARTH 402 (consult with an academic adviser for alternative options)	3	Supporting Course (consult with an academic adviser for options)	3
GEOSC 160 (consult with an academic adviser for alternative options)	3	Advanced Elective (consult with an academic adviser for options)	3
Supporting Course (consult with an academic adviser for options)	3	General Education Course (GHW)	1.5
	<b>16</b>		<b>14.5</b>

### Fourth Year

Fall	Credits	Spring	Credits
ASTRO 120 or 130 <sup>*##</sup>	3	METEO 101 (consult with an academic adviser for alternative options) <sup>†</sup>	3
GEOSC/BIOL 474 <sup>*</sup>	3	Advanced Elective (consult with an academic adviser for options)	3
Advanced Elective	3	Supporting Course (consult with an academic adviser for options)	3
General Education Course	3	General Education Course	3
General Education Course	3	General Education Course	3
General Education Course (GHW)	1.5		
	<b>16.5</b>		<b>15</b>

### Total Credits 122

\* 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.

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<https://science.psu.edu/astro> (<https://science.psu.edu/astro/>)

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.

## Career Paths

### Careers

Students in the Planetary Science & Astronomy major have flexibility in this program to customize the coursework to their anticipated career path. Many students choose careers in astronomy education or science communication, which may include work in the planetarium field or as K-12 classroom teachers. The coursework in the major also allows for students to prepare for careers at observatories or as data analysts for major astronomy projects. Students wishing to pursue careers in a technical industry are encouraged to complete a minor that will enhance the preparation in the major.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE PLANETARY SCIENCE AND ASTRONOMY PROGRAM (<https://science.psu.edu/astro/undergrad/planetary-science-and-astronomy-major/>)

### Opportunities for Graduate Studies

Students interested in formal or informal education often seek a Master's program that will provide them teaching certification or coursework specific to the museum / science center / planetarium field. While there are specific PhD programs in planetary science, students with this interest are encouraged to carefully plan their undergraduate coursework with an adviser so they are prepared to apply for these programs. The related Astronomy & Astrophysics (ASTRO) major may be a better option for students wishing to go into a Ph.D. program in Planetary Science.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<https://science.psu.edu/astro/undergrad/planetary-science-and-astronomy-major/>)

### Professional Resources

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

## Contact

### University Park

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