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 both learn to 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:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>95-99</td>
</tr>
</tbody>
</table>

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.

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 (http://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.)
- Quantification (GQ): 6 credits
- Writing and Speaking (GWS): 9 credits

Knowledge Domains
- Arts (GA): 6 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 6 credits
- Social and Behavioral Sciences (GS): 6 credits
- Natural Sciences (GN): 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)
- Inter-Domain or Approved Linked Courses: 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). For more information, check the Suggested Academic Plan for your intended program.

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 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44). For more information, check the Suggested Academic Plan for your intended program.

Code | Title | Credits
--- | --- | ---
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

Prescribed Courses: Require a grade of C or better

ASTRO 401 | Fundamentals of Planetary Science and Astronomy | 4
ASTRO 402 | 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

Additional Courses

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:

ASTRO 1 | Astronomical Universe | 3
ASTRO 5 | The Sky and Planets
ASTRO 6 | Stars, Galaxies, and the Universe

ASTRO 291 | Astronomical Methods and the Solar System | 3-4
CMPSC 101 | Introduction to C++ Programming
CMPSC 121 | Introduction to Programming Techniques
CMPSC 201 | Programming for Engineers with C++
CMPSC 202 | Introduction to Spreadsheets and Databases

Select three of the following:

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:

EARTH 2 | The Earth System and Global Change | 3
GEOSC 1 | Physical Geology
GEOSC 20 | Planet Earth

Select 12 credits of the following:

EARTH 100 | Environment Earth | 12
EARTH 103 | Earth in the Future: Predicting Climate Change and Its Impacts Over the Next Century | 3
EARTH 106 | The African Continent: Earthquakes, Tectonics and Geology
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

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

1 At least 6 credits from the below categories must be at the 400 level.

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 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy)
**Suggested Academic Plan**

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2019-20 academic year. To access previous years’ suggested academic plans, please visit the archive [bulletins.psu.edu/undergraduate/archive](http://bulletins.psu.edu/undergraduate/archive) to view the appropriate Undergraduate Bulletin edition (Note: the archive only contain suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin).

**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

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTRO 20</td>
<td>2 CHEM 110*‡#†</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MATH 140*‡#†</td>
<td>4 CHEM 111†</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ASTRO 1, 5, or 6</td>
<td>3 MATH 141†</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>GEOSC 1*‡#†</td>
<td>3 ASTRO 120 or 130*‡#†</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>General Education Course</td>
<td>3 ENGL 15, 30, or ESL 15†</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>14</td>
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</table>

### Second Year

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

### Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTRO 401*</td>
<td>4 PHYS 402*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENGL 202C†‡</td>
<td>3 PHYS 212 or 251</td>
<td>4</td>
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</tr>
<tr>
<td>EARTH 402 (consult with an academic adviser for alternative options)</td>
<td>3 Supporting Course (consult with an academic adviser for options)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEOG 160 (consult with an academic adviser for alternative options)</td>
<td>3 Advanced Elective (consult with an academic adviser for options)</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

|  |  |  |  |
| Supporting Course (consult with an academic adviser for options) | 3 General Education Course (GHW) | 1.5 |
| | | | |

### Fourth Year

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

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 University 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.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of ‘C’ or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. 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 (http://astro.psu.edu/academics/undergraduate-studies/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 (http://astro.psu.edu/academics/undergraduate-studies/planetary-science-and-astronomy-major)

Professional Resources
• American Astronomical Society (http://www.aas.org)
• Astronomical Society of the Pacific (http://www.astrosociety.org)

Contact
University Park
DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS
525 Davey Lab
University Park, PA 16802
814-865-0418
rcm242@psu.edu

http://astro.psu.edu