

# Physics and Astronomy Plans of Study

## A typical path through the **physics** major

### *First year:*

*Fall:* Physics 5: The World of Particles and Waves

*Spring:* Physics 6: Foundations of Contemporary Physics

### *Second year:*

*Fall:* Physics 7: Introductory Mechanics

Physics 63: Procedures in Experimental Physics (0.5 cr)

*Spring:* Physics 8: Electricity, Magnetism, and Waves

\*<sup>^</sup>Physics 64: Procedures in Computational Physics (0.5 cr)

### *Third year:*

*Fall:* †Physics 107: Quantum Mechanics

†Physics 112: †Electrodynamics — or fourth year

\*Physics 62: Journal Club (0.5 cr)

*Spring:* †Physics 111: Analytical Dynamics

†Physics 114: Statistical Physics — or fourth year

Physics 81: Advanced Laboratory I (0.5 cr)

### *Fourth year:*

*Fall:* Physics 82: Advanced Laboratory II (0.5 cr)

\*Physics 13x: Elective seminar or Physics 112

Physics 97 (senior conference) for course majors (0.5 cr)

\*Physics 180: Thesis for some honors majors

*Spring:* \*Physics 13x: Elective seminar or Physics 114

\*Not required for the major.

Courses in gray are optional.

<sup>^</sup>Physics 64: Procedures in Computational Physics (0.5 cr) will be offered for the first time in spring 2024.

†Three of Physics 107, 111, 112, and 114 are required for the major, along with a fourth full semester of advanced work in our department. Students can meet that requirement by taking all four seminars; by taking three plus an elective seminar (13x) or an astrophysics seminar (100-level); or by taking a full credit of research or journal club. Taking all four seminars (plus some of the other things) are strongly recommended for students pursuing graduate work in physics.

Majors graduating in 2023 do not need to take Physics 82.

This represents a typical path through the major for a student who starts in Physics 5 as a first-year student and has completed multi-variable calculus by the end of their third semester. Completing all four of Physics 107-114 during junior year represents a rapid pace through the major, meeting nearly all the major requirements by the end of the third year. Many alternate schedules are possible. It is common to take 112 and/or 114 during senior year. But at least one upper-level credit should be taken each semester of the junior year.

Non-standard entries into the major sequence are possible (and not just because the major can be completed — at a rapid pace — in three years). Note that a student can start the major sequence in the spring, with Physics 6, and take Physics 5 later. Note also that Engineering 6 plus Physics 3 can be substituted for Physics 7.

Elective seminars (13x) offered recently include General Relativity (130), Non-Linear Dynamics (132), Condensed Matter Physics (135), Cosmological Physics (137), Plasma Physics (138), and Biological Physics (139). They are not required for the major, but taking at least one is strongly recommended, especially for a student intending to go on to graduate study.

Study abroad is possible for astro/physics majors, but it is often important that some of the courses taken abroad count toward the major.

The course major and honors major requirements for classes, seminars, and labs are identical. In practice, the only difference between the course and honors major curricula are the external exams and the opportunity to write an honors thesis. Senior thesis is an

option for students in the honors program, but not a requirement; non-thesis research can be pursued during the semester by any student via Astro/Physics 94.

All majors, regardless of their participation in the honors program, are encouraged to participate in research one summer or semester.

Astrophysics and astronomy are two additional majors offered by our department. Because you can't minor in something within your major department, you can't major in physics and minor in astro. The functional equivalent of that is the astrophysics major, which requires all the classes required for the physics major except Physics 63, 81, and 82, and also requires Astro 16 and two 100-level astronomy seminars. The 20-credit rule is waived for astrophysics majors.

The astronomy major shares nearly the first four semesters in common with the physics major, but then requires Astro 14, Astro 16, Astro 61, and the three 100-level astronomy seminars offered at Swarthmore. An advanced astronomy course from Haverford or Bryn Mawr can, with the consent of the advisor, be substituted for one of these courses or seminars. A student wishing to make this substitution should confirm in advance that the selected course is acceptable for this purpose.

Typical courses of study for these two astro majors are listed on the following pages.

## A typical path through the **astrophysics** major

### *First year:*

*Fall:* Physics 5: The World of Particles and Waves

*Spring:* Physics 6: Foundations of Contemporary Physics

#Astro 14: Astrophysics: The Solar System and Cosmology

### *Second year:*

*Fall:* Physics 7: Introductory Mechanics

#Astro 16: Astrophysics: Stars, ISM, and Galaxies

*Spring:* Physics 8: Electricity, Magnetism, and Waves

\*^Physics 64: Procedures in Computational Physics (0.5 cr)

### *Third year:*

*Fall:* †Physics 107: Quantum Mechanics

†Physics 112: †Electrodynamics — or fourth year

*Spring:* †Physics 111: Analytical Dynamics

†Astro 121: Observational Techniques — or fourth year

### *Fourth year:*

*Fall:* †Astro 126: Interstellar Medium — or third year; or †Astro 123: Stars in the spring

†Physics 112: Electrodynamics — or third year

Physics 97 (senior conference) for course majors (0.5 cr)

\*Astro 180: Thesis for some honors majors

*Spring:* †Physics 114: Statistical Physics — or third year; or †Physics 137: Cosmology

\*Astro 61: Journal Club (0.5 cr)

\*Not required for the major.

Courses in gray are optional.

^Physics 64: Procedures in Computational Physics (0.5 cr) will be offered for the first time in spring 2024.

#One of Astro 14 and 16 is required for the astrophysics major, but not both.

†Three of Physics 107, 111, 112, and 114 are required for the major, along with two astrophysics seminars and also along with a fourth full semester of advanced work in our department. Students can meet that requirement by taking all four physics seminars; by taking three plus an elective seminar (13x) or a third astrophysics seminar (100-level); or by taking a full credit of research or journal club.

Sometimes Physics 130 or Physics 137 can be counted as astronomy seminars depending on how they fit into a student's overall program; students wishing to make this substitution must receive permission of the department. Students pursuing graduate work in astrophysics are strongly encouraged to confer with faculty about what set of 100-level offerings will make for a strong application.

## A typical path through the **astronomy** major

### *First year:*

*Fall:* Physics 5: The World of Particles and Waves

*Spring:* Physics 6: Foundations of Contemporary Physics

#Astro 14: Astrophysics: The Solar System and Cosmology

### *Second year:*

*Fall:* Physics 7: Introductory Mechanics

#Astro 16: Astrophysics: Stars, ISM, and Galaxies

*Spring:* Physics 8: Electricity, Magnetism, and Waves

\*^Physics 64: Procedures in Computational Physics (0.5 cr)

### *Third year:*

*Fall:* †Physics 107: Quantum Mechanics

*Spring:* †Physics 111: Analytical Dynamics

†Astro 121: Observational Techniques — or fourth year

### *Fourth year:*

*Fall:* Astro 126: †Interstellar Medium

Physics 97 (senior conference) for course majors (0.5 cr)

\*Astro 180: Thesis for some honors majors

*Spring:* †Astro 123: Stars

†Astro 61: Journal Club (0.5 cr)

\*Not required for the major.

Courses in gray are optional.

^Physics 64: Procedures in Computational Physics (0.5 cr) will be offered for the first time in spring 2024.

#One of Astro 14 and 16 is required for the astronomy major, but not both. However, if a student takes both, then only three seminars rather than four are required.

†Four astronomy seminars (100-level course) plus Astro 61 are requirements for majors. See note (#) above regarding Astro 14/16. Upper level astronomy courses at Haverford sometimes can count as a fourth seminar. Permission for this from a student's advisor is required prior to the start of the semester.

# Degree Requirements from the College Catalog

<https://catalog.swarthmore.edu/content.php?catoid=7&navoid=171>

## 9.1 Bachelor of Arts and Bachelor of Science

The degree of Bachelor of Arts or Bachelor of Science is conferred by faculty vote upon students who have met the following requirements for graduation:

1. Completed 32 course credits or their equivalent.
2. An average grade of at least C in the Swarthmore courses counted for graduation (see [section 8.2.6](#)). A student with more than 32 credits may use the Swarthmore credits within the highest 32 for the purposes of achieving the C average.
3. Complied with the distribution requirements and have completed at least 20 credits outside one major subject (see [section 7.2](#)).
4. Fulfilled the foreign language requirement, having either: (a) successfully studied 3 years or the “block” equivalent of a single foreign language during grades 9 through 12 (work done before grade 9 cannot be counted, regardless of the course level); (b) achieved a score of 600 or better on a standard achievement test of a foreign language; (c) passed either the final term of a college-level, yearlong, introductory foreign language course or a semester-long intermediate foreign language course; or (d) learned English as a foreign language while remaining demonstrably proficient in another.
5. Met the requirements in the major and supporting fields during the last 2 years. (For requirements pertaining to majors and minors, see [section 7.4](#)).
6. Passed satisfactorily the comprehensive requirement in the major field or met the standards set by visiting examiners in the Honors Program.
7. Completed four semesters of study at Swarthmore College. Two of these must constitute the senior year (i.e., the last two full-time semesters of degree work), with the exception that seniors during the first semester of their senior year, with the approval of the chair(s) of their major department(s), may participate in the Swarthmore Semester/Year Abroad Program. (For more information regarding the senior year rule, see [section 7.6.1](#)).
8. Completed the physical education requirement set forth in the Physical Education and Athletics Department statements.
9. Paid all outstanding bills and returned all equipment and library books.