PROPOSED PORTHOLE FOR ASTRONOMY MAJORS

Information for Astronomy Majors

The Astronomy Major at Cornell University is designed to be flexible so that it can be customized to the needs of each student. There is a common core set of courses (Link to details on Core Courses) followed by two concentration paths:

The **Astrophysics Concentration** is designed for those who intend to go on to graduate school in the physical sciences such as Astronomy, Physics, or Engineering. (Link to details on Astrophysics Concentration)

The **General Astronomy Concentration** is intended for students who do not plan on research careers in astronomy, but may have more broad intellectual interests, and are interested in related career paths, such as education or public outreach. The flexibility offered by the General Astronomy Concentration make it suitable to be elected as second major by broad group of students. (Link to details on General Astronomy Concentration)

To apply for a major in Astronomy, please contact the Astronomy DUS. (Link to DUS email account)

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**ASTRONOMY MAJOR**

**CORE REQUIREMENTS**  
(7 courses, 27-28 credit hours total)

- 3 Semester Introductory Sequence in Physics
- 2 Semester Introductory Sequence in Mathematics  
  plus 1 additional course in Mathematics
- 1 Experimental or Data Analysis Course in Astronomy

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**ASTROPHYSICS CONCENTRATION**

**REQUIREMENTS**  
(10 courses, 39 credit hours total)

- 5 additional courses in Physics
- 3 additional courses in Mathematics
- 2 additional courses in Astronomy

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**GENERAL ASTRONOMY CONCENTRATION**

**REQUIREMENTS**  
(9-10 courses, 32-33 credit hours total)

- 5 additional courses in Astronomy
- 15 credits in a complementary area of study
Astronomy Major Core Requirements

The Astronomy Major consists of six core courses in Physics and Mathematics and a laboratory course in Astronomy that are required for every concentration (27-28 credits total), plus additional courses specifically called out to meet the needs of each individual concentration. To enter the major, a student must have completed at least two Physics, and two Mathematics core courses as listed below with a GPA of at least 3.0. To count towards the major, the minimum grade for any required course is C-. The major is normally entered into after consultation with the Director of Undergraduate Studies (DUS) [Link to the DUS] in astronomy during the student’s fourth semester of work at Cornell. The DUS and student together will also select a suitable faculty advisor in the Field of Astronomy at this time. The required core courses are:

**Three semesters of Physics** including:

- PHYS 1112 (4 credit hours)  Physics I: Mechanics
- or PHYS 1116 (4)  Physics I: Mechanics and Special Relativity
- PHYS 2213 (4)  Physics II: Heat and Electromagnetism
- or PHYS 2217 (4)  Physics II: Electricity and Magnetism
- PHYS 2214 (4)  Physics III: Waves, Optics, and Particles
- or PHYS 2218 (4)  Physics III: Waves and Thermodynamics

**Three Semesters of Mathematics** including:

- MATH 1910 (4)  Calculus for Engineers
- or MATH 1120 (4)  Calculus II
- or MATH 1220 (4)  Honors Calculus II
- MATH 1920 (4)  Multivariable Calculus for Engineers
- or MATH 2220 (4)  Multivariable Calculus
- or MATH 2240 (4)  Theoretical Linear Algebra and Calculus
- MATH 2930 (4)  Differential Equations for Engineers
- or MATH 4710 (4)  Basic Probability
- or ASTR 3340 (4)  Symbolic and Numerical Computing

**One Laboratory Course in Astronomy** chosen from:

- ASTR 4410 (4)  Experimental Astronomy
- or ASTR 3310 (3)  Planetary Image Processing
- or ASTR 3334 (3)  Modern Astrophysical Techniques

For those pursuing an Astrophysics Concentration, ASTR 4410 is required.

In addition to these core requirements, each Astronomy Major must complete a **Concentration** in either **Astrophysics** or **General Astronomy**, which is an additional set of 9-10 courses concentrated in areas relevant to their future career goals.
Astrophysics Concentration

The Astrophysics Concentration is designed for those who intend to go on to graduate school in the physical sciences such as Astronomy, Physics, or Engineering. To enter the Astrophysics Concentration, the student must normally have a GPA better than 3.2 in the Astronomy Major Core Courses. The Astrophysics Concentration requires the following additional 10 courses (39 credit hours total):

Two Semesters of Advanced Astrophysics selected from two of the three courses in the ASTR 4431, 4432, 4433 sequence:

- ASTR 4431 (4)  Stellar Structure and Evolution
- ASTR 4432 (4)  Interstellar Medium and Galaxy Evolution
- ASTR 4433 (4)  Introduction to Cosmology

Five semesters of Physics including:

- PHYS 3316 (3)  Basics of Quantum Mechanics
- PHYS 3314 (4)  Intermediate Mechanics
  or PHYS 3318 (4)  Analytical Mechanics
- PHYS 3323 (4)  Intermediate Electricity and Magnetism
  or PHYS 3327 (4)  Advanced Electricity and Magnetism
- PHYS 3341 (4)  Thermodynamics and Statistical Physics
- PHYS 4443 (4)  Introductory Quantum Mechanics

Three Semesters of Mathematics including:

- MATH 2940 (4)  Linear Algebra for Engineers
  or MATH 2210 (4)  Linear Algebra
  or MATH 2230 (4)  Theoretical Linear Algebra and Calculus
- AEP 4210 (4)  Mathematical Physics I
- AEP 4220 (4)  Mathematical Physics II

Research Experience:

It is highly recommended that the a student with an Astrophysics concentration have at least as semester or summer research experience under the guidance of a faculty in the Astronomy Field.

Course/Credit Count. The requirements for the Astronomy Major with an Astrophysics Concentration are therefore **16 courses totaling 66-67 credit hours.**
General Astronomy Concentration

The General Astronomy Concentration is designed for students who do not plan on a research career in astronomy, but plan careers in related fields such as education, or public outreach. The flexibility offered by the General Astronomy Concentration make it suitable to be elected as second major by broad group of students. The General Astronomy Concentration requires five additional courses in Astronomy (17-18 credits total), plus an additional 15 credits in an External Concentration (four to five courses) as explicated below.

Five Semesters of Astronomy including ASTR 2211 and ASTRO 2212, two of the three courses in the ASTR 3301, 3302, 3303 sequence, and one additional astronomy course selected from below:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ASTR 2211</td>
<td>Stars, Galaxies and Cosmology</td>
</tr>
<tr>
<td>ASTR 2212</td>
<td>The Solar System: Planets, Satellites and Rings</td>
</tr>
<tr>
<td>ASTR 2290</td>
<td>Relativity and Astrophysics</td>
</tr>
<tr>
<td>ASTR 2299</td>
<td>Search for Life in the Universe</td>
</tr>
<tr>
<td>ASTR 3301</td>
<td>Exoplanets and Planetary Systems</td>
</tr>
<tr>
<td>ASTR 3302</td>
<td>The Life of Stars: From Birth to Death</td>
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<tr>
<td>ASTR 3303</td>
<td>Galaxies Across Cosmic Time</td>
</tr>
<tr>
<td>ASTR 4434</td>
<td>Evolution of the Planets</td>
</tr>
<tr>
<td>ASTR 4445</td>
<td>Introduction to Relativity</td>
</tr>
<tr>
<td>ASTR 4490</td>
<td>Senior Seminar Critical Thinking</td>
</tr>
</tbody>
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Fifteen Credit Hours in Complementary Area. Complementary Areas can be selected from a wide variety of disciplines, but the courses selected must be cohesive, and complement the core requirements. For example, those interested in astrobiology might chose a Complementary Area of biological sciences, those interested in planetary science might pick Earth and Atmospheric Science, those interested in teaching at the high-school level might pick education, and those interested in public policy might pick Government, Economics, or Science and Technology Studies. It is up to the student, in consultation with their faculty advisor to design the Complementary Area. At least eight of the Complementary Area credits must be in courses numbered above 3000. Complementary Areas are normally mapped out by the end of their sophomore year.

Course/Credit Count. The requirements for the Astronomy Major with a General Astronomy Concentration are therefore 16-17 courses (12 of which are in Astronomy, Physics and Mathematics) totaling 59-61 credit hours (44-46 of which are in Astronomy, Physics, and Mathematics).

Double Majors

It is expected that some majors, especially those with General Astronomy Concentrations will have double majors, either totally distinct from Astronomy, or ones that include courses from their Complementary Area. In these cases, their Complementary Area credits can be counted for both majors as allowed by the second major. For example, students may double major in Astronomy and Mathematics with the Astronomy Core MATH courses counted towards both majors. However, it is not allowed to double major in Astronomy with an Astrophysics Concentration, and Physics due to extensive overlap of requirements.