# Astrophysics

## Freshman Year

**Fall Semester**
- Math 1371 Calculus I (placement into course or pre-req)
- Phys 1301W Intro Phys I (&Math 1371)
- CSE 1001: 1st Yr Experience
- Liberal Education course or Writ 1301

**Spring Semester**
- Math 1372 Calculus II (1371)
- Phys 1302W Intro Phys II (1301, &Math 1372)
- Liberal Education course or Writ 1301

## Sophomore Year

**Fall Semester**
- Math 2373 Linear Alg & Diff Eqs (1372)
- Phys 2201 Thermodynamics and Stat Physics (1302, Math 1372)

**Spring Semester**
- Math 2374 Multivariable Calc (1372)
- Phys 2503 Phys III: Waves, Optics (1302, Math 1372)

## Junior Year

**Fall Semester**
- Math 3xxx or 4xxx*
- Phys 4002 Elect & Magnetism (2503 or 2601 or Chem 4501 or 4502)
- Ast 4xxx or 5xxx

**Spring Semester**
- Phys 4001 Analytical Mech (2503 or 2601 or Chem 4501 or 4502)
- Liberal Education course
- Technical Elective

**Senior Year**

**Fall Semester**
- Ast 4994W Senior Thesis
- Technical Elective
- Open Elective (If needed to reach 120 credits)

**Spring Semester**
- Technical Elective
- Open Elective (If needed to reach 120 credits)
- Open Elective (If needed to reach 120 credits)

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### About This Plan
- This plan is not a contract. Curriculum can change.
- Shaded courses are only offered in the indicated semester.
- Course pre-requisites and co-requisites (designated by &) are listed below the course number and title.
- Students can take either the CSE-only or University-wise version of the math course (Math 1371/1271, 1372/1272, 2373/2243, 2374/2263).
- Double-boxed courses, along with one of two courses with a dashed outline, are required for application to this major.
- At least one course with the dashed outline must be completed in order to apply to major.
- Liberal Education and Writing requirements with an (*) will be fulfilled by taking courses required for this major at UM-TC.

### Applying to Your Major

Students who have completed the required courses for admission to this major and have a 3.2 UM-TC technical GPA at the end of the fall semester will be guaranteed admission. All other students who have completed the required courses will be considered for admission on a space-available basis. Admission following the spring semester is only based on space availability. The major application database is available at z.umn.edu/csemajorapp.

### Writing Requirements

- University Writing:
  - Writ 1301/1401 or equivalent
- Writing Intensive (WI):
  - Two: 1xxx or 2xxx level **
  - One: 3/4/5xxx level (in major)*
  - One: 3/4/5xxx level (any dept.)

### Department Contact Information
- Website: www.astro.umn.edu/undergrad/
- Main Phone: 612-624-0211
- Main Office: 356 Tate Lab
- Director of Undergraduate Studies: Dr. Liliya Williams
- Email: llrw@astro.umn.edu

### University Degree Requirements

All students must complete the following Writing & Liberal Education requirements, as noted on their APAS report. See link for full Core & Theme names: z.umn.edu/liberaleducation

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### Total Credits Needed for Degree: 120
What can I do with a major in astronomy and astrophysics?

Astronomy is sometimes considered a subfield of physics. Astrophysics is a specialization in the field of astronomy. Astronomers use the principles of physics and mathematics to learn about the fundamental nature of the universe, including the sun, moon, planets, stars, and galaxies. They also apply their knowledge to solve problems in navigation, space flight, and satellite communications or develop the instrumentation and techniques used to observe and collect astronomical data.

Nearly all astronomers do research. Some are theoreticians, working on the laws governing the structure and evolution of astronomical objects. Others analyze large quantities of data gathered by observatories or satellites and write scientific papers on their findings. Some astronomers operate large space- or ground-based telescopes, usually as part of a team. A small number of astronomers work in planetariums developing programs presented to the public and directing planetarium operations.

Most careers in basic research require a doctoral degree. It is common for astronomers to spend three to six years in postdoctoral positions before finding a steady position in a university department, national facility, or government lab. Those with master’s degrees qualify for some jobs in applied research and development, while those with only bachelor’s degrees qualify for research assistant positions or other physics related occupations, such as technicians. Graduates typically work in a wide range of capacities such as business and private industry, education, national observatories, government laboratories, planetariums, museums, public service, and science journalism.

**Employers (sample listing)**

- NASA
- Smithsonian Astrophysical Observatory
- Intel Corporation
- 3M
- Space Telescope Science Institute
- SAIC
- Honeywell
- The Aerospace Corporation
- Akiom
- MIT Lincoln Laboratory
- Emerson Network Power
- Alliant Techsystems
- Lawrence Livermore National Lab
- Fish and Richardson, P.C.

**Industries (sample listing)**

- Institutes
- Research and Development
- Museums
- Universities
- Government
- Planetariums
- Education
- Military

**Positions (sample listing)**

**Astronomer:** Solves problems in navigation, space flight, and satellite communications and develops the instrumentation and techniques used to observe and collect astronomical data.

**Professor/Teacher:** Develops and teaches astronomy/astrophysics curriculum, including scientific experiments.

**Physicist:** Conducts research on the phases of physical phenomena, develops theories and laws from observation and experiments, and devises methods to apply laws and theories to industry and other fields.

**Data Analyst:** Analyzes problems and develops creative solutions.

**Instrument Designer:** Uses CAD programming for satellite and rocket projects.

**Research Scientist:** Conducts experiments, analyzes findings, operates necessary equipment and develops and tests theories.

**Support Astronomer:** Provides instruction, assistance, and scientific guidance to observers on the use of the observatory’s telescopes and instruments.

**Telescope Engineer:** Assists with the design, development, fabrication, and commissioning of telescopes.

*Some positions may require an advanced degree*