

Astronomy/Planetary Sciences (AST)**Major and Minor in Astronomy/Planetary Sciences****Department of Physics and Astronomy, College of Arts and Sciences**

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Minors of particular interest to students majoring in Astronomy: Electrical Engineering (ESE), Electronic, Optical, and Magnetic Materials (EOM), Mathematics (MAT), Optics (OPT), Science and Engineering (LSE)

Department Information - Astronomy/Planetary Sciences (AST)

Astronomy is the scientific discipline dedicated to the study of everything in the universe outside the Earth's atmosphere. The undergraduate major leading to the Bachelor of Science degree in astronomy/planetary sciences prepares a student for graduate and professional work. Graduates with a degree in astronomy teach in secondary schools, work in academic, government, and industrial laboratories, and teach and conduct research at colleges and universities.

Course requirements for the B.S. program are listed below and are summarized in the accompanying chart. When the student declares the Astronomy major, the director of undergraduate studies assigns a faculty advisor to the student. This advisor assists the student in the selection of courses. Students should consult frequently with their faculty advisors regarding their progress and regarding appropriate science courses. Because the position of the scientist in society is responsible and complex, the student is cautioned to pay careful attention to general education in the arts, humanities, and social sciences.

Requirements for the Major in Astronomy/Planetary Sciences

The major in Astronomy leads to the Bachelor of Science degree. Up to three astronomy or physics courses passed with a C- may be applied to the major; all other courses offered for the major must be passed with a letter grade of C or higher.

Completion of the major requires 63 to 66 credits.

A. Required Astronomy Courses:

1. AST 203 Astronomy, AST 341 Stars and Radiation, AST 346 Galaxies, AST 347 Cosmology
2. At least six credits from additional AST courses numbered 205 or higher (except AST 248, AST 301, AST 389, and AST 475). Up to three credits of AST 287, AST 447, and AST 487 may be used toward this requirement.

B. Required Physics Courses:

1. PHY 131/PHY 133, PHY 132/PHY 134 Classical Physics I, II and labs (See Note 1)
2. PHY 251/PHY 252 Modern Physics with Laboratory
3. PHY 277 Computation for Physics and Astronomy
4. PHY 300 Waves and Optics
5. PHY 306 Thermodynamics, Kinetic Theory, and Statistical Mechanics

C. Eight credits of astronomy-related courses that complement an astronomy major's education are required. The intent is to add courses, especially in other quantitative sciences, which prepare the student for successful employment in research, education or industry. Any course beyond those required for the astronomy major that is required by the student's minor, second major or master's degree (for students in a combined degree program) is automatically included in the list of related courses. Additional related courses are listed under the related courses for the physics major. Any course at the 300-level or above on this list may be used. In addition any physics course at the 300-level or above not required for the astronomy major may also be used.

D. Mathematics Requirements:

1. MAT 131, MAT 132 Calculus I, II (See Note 2 below). If students do not place into MAT 125 or 131 on the basis of the math placement examination, MAT 123 is a required course for the major.

2. One of the following: MAT 203 Calculus III with Applications or MAT 205 Calculus III or AMS 261 Applied Calculus III or MAT 307 Multivariable Calculus with Linear Algebra
3. One of the following: MAT 303 Calculus IV with Applications or MAT 305 Calculus IV or AMS 361 Applied Calculus IV: Differential Equations or MAT308 Differential Equations with Linear Algebra

E. Upper-Division Writing Requirement:

Students are certified as satisfying the upper-division writing requirement by registering for the 0-credit AST 459 and completing writing projects within their major. All students majoring in Astronomy/ Planetary Sciences must submit two papers (term papers or independent research papers) to the Astronomy coordinator for Department evaluation by the end of the junior year. If this evaluation is satisfactory, the student will have fulfilled the upper- division writing requirement. Papers should be written in the form of a journal article. All papers must consist of an abstract, introduction, main content, and references. References should be cited throughout the text. Any figures should be numbered and have an appropriate caption. If you are using a lab report for the basis of this requirement, you should expand upon the introduction and describe the connection to topical scientific research.

A typical length should be 10 pages (double spaced, 11-point font) plus references, preferably written in LaTeX.

Students should consult with the department advisor to ensure that their plan for completing the Upper Division Writing Requirement is consistent with university graduation requirements for General Education. Students completing the Stony Brook Curriculum (SBC) must complete a course that satisfies the "Write Effectively within One's Discipline" (WRTD) learning objective to graduate. The Upper Division Writing Requirement is consistent in most cases with the SBC learning outcomes for WRTD.

Notes:

1. The following physics courses are alternatives to PHY 131/PHY 133 + labs PHY 132/PHY 134 (collectively called the PHY 131-Sequence): PHY 125, 126, 127, with labs PHY 133 and 134 (collectively called the PHY 125-Sequence) or PHY 141/133 and 142/134 (Collectively called the PHY 141-Sequence).
2. The following alternate beginning calculus sequences may be substituted for MAT 131, MAT 132 in major requirements or prerequisites: MAT 125, MAT 126, MAT 127 or MAT 141, MAT 142 or MAT 171. Equivalency for MAT courses achieved by earning the appropriate score on the Mathematics Placement Examination will be accepted as fulfillment of the requirement without the necessity of substituting other credits. For detailed information about the various calculus sequences, see the alphabetical listing for Mathematics, especially "Beginning Mathematics Courses," and the course descriptions.

Honors Program in Astronomy/Planetary Sciences

Students in the Astronomy/Planetary Sciences major who have maintained a cumulative grade point average of 3.30 through the junior year in courses required for the major may apply to the Department to become candidates for Departmental honors in astronomy/planetary sciences. Candidates for honors in astronomy/planetary sciences must include a sequence of mathematics, physics, or engineering courses approved by the student's advisor following petition by the student.

In addition to the academic program, the student must complete an honors thesis while enrolled in AST 447 or AST 487. The thesis is evaluated by a committee composed of the student's advisor and two other science faculty members including one from outside of the Department. If the honors program is completed with distinction and the student has maintained a minimum 3.30 grade point average in all coursework in natural sciences and mathematics, honors are conferred.

Requirements for the Minor in Astronomy (AST)

All courses offered for the minor must be passed with a letter grade of C or higher. Completion of the minor requires 23 to 24 credits.

1. AST 203 Astronomy
2. AST 205 Introduction to Planetary Sciences
3. Three additional AST courses at the 300 level or higher. No more than one of these may come from AST 301 or AST 389.
4. PHY 131/PHY 133 Classical Physics I or PHY 141/133 Classical Physics I: Honors
5. MAT 125 Calculus A or MAT 131 Calculus I or MAT 141 Honors Calculus I or MAT 171 Accelerated Single Variable Calculus or AMS 151 Applied Calculus I

Sample Course Sequence for the Major in Astronomy/Planetary Sciences

A course planning guide for this major may be found here.

FRESHMAN

FALL	Credits
First Year Seminar 101	1
WRT 101	3
AST 100	1
PHY 131/PHY 133 or PHY 141/PHY 133	4
MAT 131 or MAT 141	4

SBC	3
Total	16

SPRING	Credits
First Year Seminar 102	1
WRT 102	3
PHY 132/PHY 134 or PHY 142/PHY 134	4
MAT 132 or MAT 142	4
SBC	3
SBC	3
Total	18

SOPHOMORE

FALL	Credits
PHY 251/PHY 252	4
MAT 205 or AMS 261	3
AST 205	3
PHY 277	3
Upper-division SBC	3
Total	16

SPRING	Credits
PHY 306	3
MAT 305 or AMS 361	3
AST 200	1
AST 203	4
Upper-division SBC	3
Total	14

JUNIOR

FALL	Credits
AST 341 or AST 443*	3-4
MAT elective	3
PHY 301	3
PHY 303	3
SBC	3
Total	15-16

SPRING	Credits
AST 347 or AST 346*	3
PHY 308	3
PHY 300	3
Upper-division elective	3

SBC	3
Total	15

SENIOR

FALL	Credits
AST 443 or AST 341*	3-4
Upper-division SBC	3
SBC	3
SBC	3
SBC	3
Total	15-16

SPRING	Credits
AST 346 or AST 347*	3
Upper-division SBC	3
Upper-division Elective	3
SBC	3
SBC	3
Total	15

*AST 341 and AST 443 are offered in alternate fall semesters. AST 346 and AST 347 are offered in alternate spring semesters.

AST

Astronomy

AST 100: Astronomy Today

Seminar designed to introduce students to the excitement of modern astronomy, focusing on the most recent discoveries, as reported in the media. The course provides sufficient scientific background to enable students to understand the impact of these discoveries.

SBC: SPK

1 credit

AST 101: Introduction to Astronomy

Description of planets, stars, galaxies, black holes, pulsars, quasars, supernovae, and white dwarfs. Man's place in the cosmos. Cosmological theories. Students with better science preparation are encouraged to take AST 203. Not for major credit. Not for credit in addition to AST 203.

Prerequisite: Satisfaction of entry skill in mathematics requirement (Skill 1) or satisfactory completion of D.E.C. C or QPS

DEC: E

SBC: SNW

3 credits

AST 105: Introduction to the Solar System

A general survey of present knowledge of the planets, satellites, interplanetary medium, comets, asteroids, and outer regions of the sun. Begins with a historical introduction and discussion of the methods of science. Emphasizes current NASA deep-space exploration missions and other modern astronomical methods. Not for major credit. Not for credit in addition to AST 205 or GEO 106.

DEC: E

SBC: SNW

3 credits

AST 112: Astronomy Laboratory

An introduction to observational activities in astronomy. Students make astronomical measurements using simple instruments such as a quadrant, cross-staff, spectrometer, and telescope; analyze measurements; examine how quantities of interest and their errors are derived from the measurements and how they are properly reported. Not for major credit.

Pre- or Corequisite: AST 101 or 105 or 248

1 credit

AST 200: Current Astronomical Research at Stony Brook

Seminar designed to introduce students to astronomical research currently underway at Stony Brook. Faculty actively engaged in cutting edge research using facilities such as the Hubble space telescope, the CHANDRA X-Ray Observatory, the Keck and Gemini telescopes, or supercomputers give presentations on their own research. Appropriate for students considering undergraduate research in astronomy as well as students interested in current astronomy.

1 credit

AST 203: Astronomy

A survey of the physical nature of the universe for the student with some background in physics and mathematics. May not be taken for credit in addition to AST 101. Optional evening observing sessions will be held during the semester.

Prerequisite: PHY 125/133 or PHY 131/133 or PHY 141/133

DEC: E

SBC: STEM+

4 credits

AST 205: Introduction to Planetary Sciences

An introduction to the solar system for the student with a background in mathematics or physical sciences. A survey of the planets, comets, asteroids, and interplanetary medium, based upon the latest scientific discoveries. Not for credit in addition to AST 105 or GEO 106.

Prerequisite: PHY 125/133 or PHY 131/133 or PHY 141/133

SBC: STEM+

3 credits

AST 248: The Search for Life in the Universe

A study of the role of science in modern society through investigation of the question: Does life exist elsewhere in the universe? Topics include a review of the astronomical and biological settings; the origin of life on the earth and possibly elsewhere; the evolution of life and the development of intelligence and technology. Also discussed are the ramifications of the development of life and intelligence for the atmosphere and the biosphere.

Prerequisite: one D.E.C. E or SNW course

DEC: H

SBC: STAS

3 credits

AST 287: Introductory Research in Astronomy

Independent research under the supervision of a faculty member, at a level appropriate for lower-division students. May be repeated.

Prerequisites: Permission of instructor and departmental research coordinator
Advisory Prerequisites: U1 or U2 standing; one AST course

SBC: EXP+

0-3 credits

AST 301: Collisions in the Solar System

A discussion of the evidence that comet and asteroid impacts have played a significant part in the evolution of the Earth, and other planets of the solar system, as well as an assessment of the actual and perceived hazard posed by terrestrial impacts and discussion of what can be done about it. The course follows an interdisciplinary approach and is not for major credit.

Prerequisites: A lower-division 3-4 credit AST course; MAT 125 or 131 or 141 or AMS 151; PHY 121/123 or PHY 125/133 or PHY 131/133 or PHY 141/133

DEC: H

SBC: STAS

3 credits

AST 341: Stars and Radiation

An introduction to, and development of, a firm physical understanding of the observed properties of stars. Topics include the structure of the interior and atmosphere of stars, the transfer of energy by radiation in plasmas, the evolution of stars, and the end stages of stellar evolution, including white dwarfs, neutron stars, black holes and supernovae, with careful attention to the comparison of the predictions with observations.

Prerequisites: AST 203; PHY 251/252; MAT 203 or 205 or 211 or AMS 261

3 credits

AST 345: Undergraduate Research in Astronomy

Student participation in faculty-directed research projects.

Prerequisite: Permission of instructor

SBC: EXP+

0-1 credits

AST 346: Galaxies

An introduction to the properties of galaxies, including the Milky Way and others. Examination of the physical processes that govern the stars, dust, and gas in galaxies. Stellar constituents of galaxies, equilibria of collisionless systems, gas dynamics, and radiative processes.

Prerequisites: AST 203; PHY 251/252; MAT 203 or 205 or 211 or AMS 261

3 credits

AST 347: Cosmology

An introduction to physical cosmology. Examination of the physical properties that govern the galaxies and intergalactic matter in the universe. Expansion of the universe and the Friedmann equations, microwave background variation, thermal history of the universe, and nucleosynthesis.

Prerequisites: AST 203; PHY 251/252; MAT 203 or 205 or 211 or AMS 261

3 credits

AST 389: Science Fiction

The literary genre called Science Fiction enables us to explore our nature, and that of the universe we inhabit, by postulating worlds, cultures and technologies that do not (yet) exist, but could, and the consequences thereof. This course focuses on the sub-genre called hard science fiction, in which the science/technology is more or less plausible. Students should be prepared to address the genre from both its scientific and literary sides. This course is offered as both AST 389 and EGL 389.

Prerequisite: WRT 102; one D.E.C. B or HUM course; one D.E.C. E or SNW course

DEC: H

SBC: CER, STAS

3 credits

AST 443: Observational Techniques in Astronomy

An introduction to modern astronomical instrumentation and data handling and to the use of telescopes. Emphasis on techniques and equipment appropriate for wavelengths shorter than one micron. Extensive laboratory and observing exercises are required.

Prerequisite: AST 203

SBC: ESI, SPK

4 credits

AST 444: Experiential Learning

This course is designed for students who engage in a substantial, structured experiential learning activity in conjunction with another class. Experiential learning occurs when knowledge acquired through formal learning and past experience are applied to a "real-world" setting or problem to create new knowledge through a process of reflection, critical analysis, feedback and synthesis. Beyond-the-classroom experiences that support experiential learning may include:

service learning, mentored research, field work, or an internship.

Prerequisite: WRT 102 or equivalent; permission of the instructor and approval of the EXP+ contract (http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/degree_requirements/EXPplus.php)

SBC: EXP+

S/U grading

AST 447: Senior Tutorial in Astronomy

Independent readings in advanced topics to be arranged prior to the beginning of the semester. Weekly conferences are held with a faculty member. May be repeated once.

Prerequisites: U4 standing; permission of instructor

1-3 credits

AST 458: Speak Effectively Before an Audience

A zero credit course that may be taken in conjunction with any AST course that provides opportunity to achieve the learning outcomes of the Stony Brook Curriculum's SPK learning objective.

Pre- or corequisite: WRT 102 or equivalent; permission of the instructor

SBC: SPK

S/U grading

AST 459: Write Effectively in Astronomy/Planetary Sciences

A zero credit course that may be taken in conjunction with any 300- or 400-level AST course, with permission of the instructor. The course provides opportunity to practice the skills and techniques of effective academic writing and satisfies the learning outcomes of the Stony Brook Curriculum's WRTD learning objective.

Prerequisite: WRT 102; permission of the instructor

SBC: WRTD

S/U grading

AST 475: Teaching Practicum in Astronomy

Supervision of laboratory or recitation sections under the close guidance of the course instructor. Includes regular meetings with the instructor for purposes of planning and evaluation; supplementary reading in preparation for laboratory or recitation sessions; and opportunities to make oral presentations, provide individual or innovative instruction, and reinforce previously acquired knowledge.

Prerequisites: U4 standing; permission of instructor

SBC: EXP+

3 credits, S/U grading

AST 487: Senior Research in Astronomy

Under the supervision of a faculty member, a major in the department may conduct research for academic credit. A research proposal must be prepared by the student and submitted to the department chairperson for approval before the beginning of the semester in which credit is to be given. A written report must be submitted before the end of the semester. May be repeated.

Prerequisite: Permission of instructor

SBC: EXP+

0-6 credits, S/U grading