

Bachelor of Science in Astronomy

Why study physics and astronomy?

Our goal is to understand the physical universe. The questions addressed by our department's research and education missions range from the applied, such as an improved understanding of the materials that can be used for solar cell energy production, to foundational questions about the nature of mass and space and how the universe was formed and subsequently evolved, and how astrophysical phenomena affected the Earth and its evolution. We study the properties of systems ranging in size from smaller than an atom to larger than a galaxy on timescales ranging from billionths of a second to the age of the universe. Our courses and laboratory/research experiences help students hone their problem solving and analytical skills and thereby become broadly trained critical thinkers. While about half of our majors move on to graduate studies in STEM, many find employment in the private sector in diverse situations ranging from financial analysts to physicians. Graduates of all our degree programs can be found in key positions regionally, nationally, and internationally. In this way, our department is at the forefront of telling the academic story of the University of Kansas to people around the state and around the world.

Undergraduate programs in astronomy

Astronomy degrees are offered through the Department of Physics and Astronomy. The astronomy curriculum offers undergraduates a survey of modern astronomy and an introduction to physical science, gives science and engineering students an introduction to astronomy and astrophysics, and prepares students majoring in astronomy for graduate study in astronomy or related fields.

Courses for Nonmajors

ASTR 191 surveys a wide range of contemporary astronomy topics; ASTR 394 is open to students with previous coursework in astronomy, biology, or geology; ASTR 391 offers an introduction to physical astronomy at a calculus-based level.

Undergraduate Admission

Admission to KU

All students applying for admission must send high school and college transcripts to the Office of Admissions. Prospective first-year students should be aware that KU has qualified admission requirements that all new first-year students must meet to be admitted. Consult the Office of Admissions (<http://admissions.ku.edu/>) for application deadlines and specific admission requirements.

Visit the International Support Services (<http://www.iss.ku.edu/>) for information about international admissions.

Students considering transferring to KU may see how their college-level course work will transfer on the Office of the University Registrar (<https://registrar.ku.edu/creditransfer/>) website.

Advising

Students considering a major in astronomy should confer early with a departmental representative about the selection of courses. The B.A.

degree is appropriate for students who want a general education in astronomy as part of a broadly structured liberal education. The B.S. is a more specialized program with a substantial emphasis on physics content as well as astronomy. It provides preparation for a professional career or graduate work in astronomy, astrophysics, or related fields. A total of 120 credit hours is required for graduation.

First- and Second-Year Preparation

All major programs in physics and astronomy share requirements in basic physics and mathematics including PHSX 150, a seminar course for majors. Completion of MATH 125 and MATH 126 in the first year allows students to start calculus-based physics foundation courses (PHSX 211 and PHSX 216 or PHSX 213, followed by PHSX 212 and PHSX 236 or PHSX 214) by the second semester. Majors are encouraged to take PHSX 213 and PHSX 214, the honors versions of PHSX 211 /PHSX 216 and PHSX 212 /PHSX 236. Students should take these courses and ASTR 391 in their first two years. B.S. astronomy majors normally complete additional course work in mathematics (MATH 127, MATH 290, and MATH 320), as well as PHSX 313 and PHSX 316, in the second year.

Requirements for the B.S. Degree in Astronomy

Code	Title	Hours
General Science Prerequisite Requirements (25.5 - 26.5 hrs)		
Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. These hours do not contribute to the minimum number of hours required for the major.		
Computing and Programming. Satisfied by one of the following:		
EECS 138	Introduction to Computing: _____	
	or EECS 166: Programming I	
	or EECS 166: Programming I: Honors	
Calculus I. Satisfied by one of the following:		
MATH 125	Calculus I	
	or MATH 144: Calculus I, Honors	
Calculus II. Satisfied by one of the following:		
MATH 126	Calculus II	
	or MATH 144: Calculus II, Honors	
Seminar in Physics, Astronomy, & Engineering Physics. Satisfied by the following:		
PHSX 150	Seminar in Physics, Astronomy and Engineering Physics	
General Physics I. Satisfied by one of the following:		
PHSX 211 & PHSX 216	General Physics I and General Physics I Laboratory	
PHSX 213	General Physics I Honors	
General Physics II. Satisfied by one of the following:		
PHSX 212 & PHSX 236	General Physics II and General Physics II Laboratory	
PHSX 214	General Physics II Honors	
Foundations of Chemistry I. Satisfied by one of the following:		
CHEM 130	General Chemistry I	
	or CHEM 15: Chemistry for Engineers	
	or CHEM 17: Chemistry for the Chemical Sciences I	

or CHEM 19 Foundations of Chemistry I, Honors
and Foundations of Chemistry I Laboratory, Honors
& CHEM 191

Advanced Mathematics Knowledge and Skills Prerequisite Requirements (12 hrs)

Vector Calculus. Satisfied by the following:

MATH 127 Calculus III
or MATH 147 Calculus III, Honors

Elementary Linear Algebra. Satisfied by the following:

MATH 290 Elementary Linear Algebra
or MATH 291 Elementary Linear Algebra, Honors

Elementary Differential Equations. Satisfied by the following:

MATH 320 Elementary Differential Equations
or MATH 220 Applied Differential Equations
or MATH 221 Applied Differential Equations, Honors

Math Elective. Satisfied by one of the following:

PHSX 518 Mathematical Physics
PHSX 718 Mathematical Methods in Physical Sciences
MATH 526 Applied Mathematical Statistics I
MATH 558 Introductory Modern Algebra
MATH 581 Numerical Methods
MATH 590 Linear Algebra
MATH 628 Mathematical Theory of Statistics
MATH 646 Complex Variable and Applications
MATH 647 Applied Partial Differential Equations
MATH 648 Calculus of Variations and Integral Equations
MATH 660 Geometry I
MATH 661 Geometry II

any 700-level MATH lecture course.

Astronomy Requirements (20-23 hrs)

Majors must complete the following seven courses:

ASTR 391	Physical Astronomy, Honors	3
ASTR 591	Stellar Astronomy	3
ASTR 592	Galactic and Extragalactic Astronomy	3
ASTR 691	Astrophysics I	3
ASTR 692	Astrophysics II	3
ASTR 503	Undergraduate Research	1-4

Capstone Course

ASTR 596	Observational Astrophysics	4
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Physics Core Knowledge and Skills (23 hrs)

Majors must complete courses as indicated in the following areas:

General Physics III. Satisfied by the following:

PHSX 313	General Physics III	3
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Intermediate Physics Lab. Satisfied by the following:

PHSX 316	Intermediate Physics Laboratory I	1
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Introductory Quantum Mechanics. Satisfied by the following:

PHSX 611	Introductory Quantum Mechanics	3
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Physical Measurements or Electronic Circuit Measurement and Design. Satisfied by one of the following:

PHSX 536 Electronic Circuit Measurement and Design
PHSX 616 Physical Measurements

Mechanics I. Satisfied by the following:

PHSX 521	Mechanics I	3
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Electricity and Magnetism. Satisfied by the following:

PHSX 531	Electricity and Magnetism	3
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Thermal Physics. Satisfied by the following:

PHSX 671	Thermal Physics	3
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Physics Elective. Satisfied by any PHSX lecture or laboratory course numbered 500 or higher (PHSX 693 recommended) (with the exception of PHSX 594), including:

ASTR 792 Topics in Advanced Astrophysics

ASTR 795 Space Plasma Physics
or PHSX 795 Space Plasma Physics

PHSX 693 Gravitation and Cosmology (recommended)

Total Hours **43-46**

Major Hours & Major GPA

While completing all required courses (above), majors must also meet each of the following hour and grade-point average minimum standards:

Major Hours

Satisfied by 43-46 hours of major courses.

Major Hours in Residence

Satisfied by a minimum of 15 hours of KU resident credit in the major.

Major Junior/Senior(300+) Hours

Satisfied by a minimum of 12 hours from junior/senior courses (300+) in the major.

Major Junior/Senior (300+) Graduation GPA

Satisfied by a minimum of a 2.0 KU GPA in junior/senior courses (300+) in the major. GPA calculations include all junior/senior courses in the field of study including F's and repeated courses. See the Semester/Cumulative GPA Calculator (<https://sis.ku.edu/gpa-calculator/>).

Below is a sample 4-year plan for students pursuing the B.S. in Astronomy. To view the list of courses approved to fulfill KU Core 34, please visit the KU Core 34 page (<https://catalog.ku.edu/core34/>).

This degree plan assumes students will have completed MATH 104, or its equivalent, prior to the freshman year, fall semester.

Freshman

Fall	Hours Spring	Hours
MATH 125 (KU Core 34: Math and Statistics (SGE); Major Requirement) ^{030*}	4 ASTR 391 (Major Requirement) ⁴	3
PHSX 150 (Major Requirement) ⁴	0.5 MATH 126 (Major Requirement)	4
CHEM 130 or 170 (Core 34: Natural and Physical Sciences (SGE); Major Requirement) ^{040*}	5 PHSX 211 & PHSX 216 (Major Requirement) ⁵	5
KU Core 34: Social and Behavior Science (SGE) ⁰⁵⁰	3 EECS 138 or 168 (Major Requirement) ⁸	3-4
KU Core 34: English (SGE) ⁰¹⁰	3	

15.5

15-16

Sophomore

Fall	Hours Spring	Hours
ASTR 591 (Major Requirement) ^{2,4}	3 ASTR 592 (Major Requirement) ^{3,4}	3
PHSX 212 & PHSX 236 (Major Requirement) ⁶	4 PHSX 313 (Major Requirement)	3
MATH 127 (Pre-requisite for Major Requirement)	4 PHSX 316 (Major Requirement)	1
MATH 290 (Major Requirement)	2 MATH 320 (Major Requirement)	3
KU Core 34: English (SGE) ⁰¹⁰	3 KU Core 34: Communications (SGE) ⁰²⁰	3
	PHSX 315	3
	16	16

Junior

Fall	Hours Spring	Hours
ASTR 596 (Capstone Requirement, Major Requirement) ^{3,4}	4 ASTR 692 (Major Requirement) ^{3,4}	3
ASTR 691 (Major Requirement) ⁴	3 PHSX 611 (Major Requirement) ⁴	3
PHSX 521 (Major Requirement) ⁴	3 PHSX 616 or 536 (Major Requirement)	4
PHSX Math Elective 300+ (Major Requirement) ¹	3 KU Core 34: US Culture (SGE) ⁰⁷⁰	3
KU Core 34: Arts and Humanities (SGE) ⁰⁶⁰	3 ASTR 503	1-4
	16	14-17

Senior

Fall	Hours Spring	Hours
PHSX 531 (Major Requirement) ⁴	3 PHSX 693, ASTR 792, ASTR 795, or PHSX 795 (PHSX lecture or lab 500+)	3
PHSX 536 or 616	4 KU Core 34: Global Culture (SGE) ⁰⁷⁰	3
PHSX 671 (Major Requirement) ⁴	3 KU Core 34: Social and Behavior Science (SGE) ⁰⁵⁰	3
KU Core 34: Arts and Humanities (SGE) ⁰⁶⁰	3 Elective	3
Elective	3 Elective	1
	16	13

Total Hours 121.5-125.5

¹ Refer to the Degree Requirements tab for a list of courses that can fulfill this major requirement.

² Offered odd-numbered years.

³ Offered even-numbered years.

⁴ PHSX 150, PHSX 521, PHSX 531, ASTR 591, ASTR 596, ASTR 691, and PHSX 671 are fall only courses. PHSX 315, PHSX 315, ASTR 592, ASTR 391, and ASTR 692 are spring only courses.

⁵ Majors are encouraged to take PHSX 213.

⁶ Majors are encouraged to take PHSX 214.

⁷ Hour requirements (incl. 45 jr/sr hrs) are typically met through Core 34, degree, major, second area of study and/or elective hours. Students completing the BGS with a major must choose a secondary area of

study. Individual degree mapping is done in partnership with your advisor.

⁸ Course offering using the python programming language recommended.

Please note:

All students in the College of Liberal Arts & Sciences are required to complete 120 total hours of which 45 hours must be at the Jr/Sr (300+) level.

Notes:

* - This course is a Required major course and is also part of KU Core 34: Systemwide General Education. If this course is not taken to fulfill the Core 34:SGE requirement, it must be taken in place of elective hours.

** - This course is a Recommended KU Core 34: Systemwide General Education course. This specific course is not required but is recommended by the program's faculty.

*** - This course is a Required KU Core 34: Systemwide General Education course. This program is approved by the Kansas Board of Regents to require this specific KU Core 34: Systemwide General Education course. If a student did not take this course it must be taken in addition to other degree requirements.

At the completion of this program, students will be able to:

- Display Astronomy Content Knowledge.
- Display Experimental Skills.
- Display Computational Skills.
- Display Discipline Specific Research Skills.

Departmental Honors in Physics and Astronomy

Qualified students earning either a B.A. or a B.S. degree in the College of Liberal Arts and Sciences with a major in astronomy or physics may graduate with Honors in Physics & Astronomy by fulfilling the following requirements: (1) By the end of the candidate's final semester, achieve a minimum GPA of 3.5 in the major, in all courses taken in residence and elsewhere; and (2) Complete at least 24 semester hours of astronomy and physics courses numbered 500 or above, including undergraduate research represented by two hours of credit in ASTR 501, ASTR 503, PHSX 501 or PHSX 503. A grade of B or better must be earned in one of the following: ASTR 501, ASTR 503, PHSX 501 or PHSX 503. All of our department's honors requirements include student research, for which results shall be presented in either: (1) a written research summary, read by 3 faculty members in physics and astronomy or related fields or authorship on a peer-reviewed manuscript; or (2) a research-based oral presentation at an appropriate venue (e.g., Undergraduate Research Symposium, a presentation in an advanced department seminar class, a discipline specific meeting); or (3) presentation of a poster at an appropriate venue. Students intending to graduate with honors in physics and astronomy must file a Declaration of Intent Form with the Departmental Honors Coordinator, preferably during their junior year but no later than enrollment for the final undergraduate semester.