Bachelor of Arts 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, 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/credittransfer/) 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 and PHSX 212 . 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.A. Major in Astronomy

All students pursuing the Bachelor of Arts in Astronomy must complete the KU Core requirements and the College BA specific requirements, listed in the KU Core and College sections of the catalog.

Co	ode	Title	Hours
Ge	eneral Science	and Math Requirements (22.5 hrs)	
Ma are Th ree	ajors must comp eas. Majors are ese hours do no quired for the m	lete courses as specified in each of the following advised to take honors courses when eligible. ot contribute to the minimum number of hours ajor.	
Ca	Iculus I. Satisfie	ed by one of the following:	
	Or equivalent		
M	ATH 125	Calculus I	4
	or MATH 145	Calculus I, Honors	
Ca	lculus II. Satisfi	ed by one of the following:	
	Or equivalent		
M	ATH 126	Calculus II	4
	or MATH 146	Calculus II, Honors	
Se the	minar in Physic e following:	s, Astronomy, & Engineering Physics. Satisfied by	ý
Pŀ	ISX 150	Seminar in Physics, Astronomy and Engineering Physics	0.5
Ge	eneral Physics I	. Satisfied by one of the following:	5
	PHSX 211	General Physics I	
	& PHSX 216	and General Physics I Laboratory	
	PHSX 213	General Physics I Honors	
Ge	eneral Physics I	. Satisfied by one of the following:	4
	PHSX 212 & PHSX 236	General Physics II and General Physics II Laboratory	
	PHSX 214	General Physics II Honors	
Fo	undations of Ch	nemistry I. Satisfied by one of the following:	
CH	IEM 130	General Chemistry I	5
	or CHEM 150	Chemistry for Engineers	
	or CHEM 170	Chemistry for the Chemical Sciences I	

or CHEM 190	Foundations of Chemistry I, Honors		
& CHEM 191	and Foundations of Chemistry I Laboratory, Honors		
Astronomy Requ	uirements (13 hrs)		
Majors must com	plete each of the four following courses:		
ASTR 391	Physical Astronomy, Honors	З	
ASTR 591	Stellar Astronomy	3	
ASTR 596	Observational Astrophysics	4	
ASTR 592	Galactic and Extragalactic Astronomy	3	
Capstone Cours	e		
PHSX 503	Undergraduate Research		
Additional astronomy, astrophysics, or physics courses required			

for major (4 hrs) In addition to the above specifically required courses, Astronomy BA candidates must complete at least 4 additional credits in physics

4

BA candidates must complete at least 4 additional credits in physics or astronomy at the 300+ level. Students may enroll in ASTR 390 for undergraduate problems for 1 or more credit hours and in ASTR 503 (ASTR 501 honors) for research credit. ASTR 394 is highly recommended. Other recommended courses include ASTR 691 and ASTR 692, PHSX 594, GEOL 572, PHSX 313/316 and other PHSX courses 500 and above; most of these course have prerequisites that may require additional preparation in mathematics and/ or physics.

39.5

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 39.5 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 16 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.A. 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 equivalent prior to the freshman year, fall semester.

Freshman

Fall	Hours Spring	Hours
KU Core 34: English (SGE) ⁰¹⁰	3 KU Core 34: English (SGE) ⁰¹⁰	3
KU Core 34: Social and Behavior Science (SGE) ⁰⁵⁰	3 KU Core 34: Communications (SGE) ⁰²⁰	3

CHEM 130 or 190 (KU Core 34: Natural and Physical Sciences (SGE);BA Lab, Maior Pre-requisite) ^{040,2*}	5	MATH 126 (Major Pre- requisite)	4
MATH 125 (KU Core 34: Math and Statistics (SGE); Major Pre-requisite) ^{030*}	4	PHSX 211 & PHSX 216 (Major Requirement), or	5
PHSX 150 (Major Requirement)	0.5	PHSX 213	
		Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	3
Canhamara	15.5		18
Fall	Hours	Spring	Hours
KU Core 34: Arts and Humanities (SGE) ⁰⁶⁰	3	ASTR 391 (Major Requirement SPRING ONLY)	3
PHSX 212 & PHSX 236 (Major Requirement) or	4	KU Core 34: Social and Behavior Science (SGE) ⁰⁵⁰	3
PHSX 214		2nd Semester Language (BA Second Language)	5
1st Semester Language (BA Second Language)	5	PHSX 315	3
EECS 138 (Python)	3		
	15		14
Junior			
F -11		Out with a	
Fall	Hours	Spring	Hours
Fall ASTR 591 (Major Requirement) ⁴	Hours 3	Spring ASTR 592 (Major Requirement) ⁴	Hours 3
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4}	Hours 3 3	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰	Hours 3 3
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4} KU Core 34: Global Culture (SGE) ⁰⁷⁰	Hours 3 3 3	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰ 4th Semester Language, or 1st semester of Another Language (BA Second Language) ¹	Hours 3 3 3
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4} KU Core 34: Global Culture (SGE) ⁰⁷⁰ 3rd Semester Language (BA Second Language)	Hours 3 3 3 3 3	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰ 4th Semester Language, or 1st semester of Another Language (BA Second Language) ¹ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4} KU Core 34: Global Culture (SGE) ⁰⁷⁰ 3rd Semester Language (BA Second Language) Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 3 3	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰ 4th Semester Language, or 1st semester of Another Language (BA Second Language) ¹ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 3 1
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4} KU Core 34: Global Culture (SGE) ⁰⁷⁰ 3rd Semester Language (BA Second Language) Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 3 3 3 15	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰ 4th Semester Language, or 1st semester of Another Language (BA Second Language) ¹ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 1 1 13
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4} KU Core 34: Global Culture (SGE) ⁰⁷⁰ 3rd Semester Language (BA Second Language) Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 3 3 15	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰ 4th Semester Language, or 1st semester of Another Language (BA Second Language) ¹ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 1 1 13
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4} KU Core 34: Global Culture (SGE) ⁰⁷⁰ 3rd Semester Language (BA Second Language) Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 3 3 15 Hours	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰ 4th Semester Language, or 1st semester of Another Language (BA Second Language) ¹ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 3 1 1 13 Hours
Fall ASTR 591 (Major Requirement) ⁴ ASTR Elective (Major Requirement) ^{3,4} KU Core 34: Global Culture (SGE) ⁰⁷⁰ 3rd Semester Language (BA Second Language) Second Area of Study/ Elective/Degree/Junior- Senior Fall ASTR 596 (Major Requirement) ⁴	Hours 3 3 3 3 3 3 3 4 5 Hours 4	Spring ASTR 592 (Major Requirement) ⁴ KU Core 34: US Culture (SGE) ⁰⁷⁰ 4th Semester Language, or 1st semester of Another Language (BA Second Language) ¹ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵ Second Area of Study/ Elective/Degree/Junior- Senior Hours ⁵	Hours 3 3 3 3 1 1 13 Hours 3
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	16	
Senior Hours		
Elective/Degree/Junior-	course 300+ (Total Hours)	
Second Area of Study/	3 Elective or possible minor	3

Total Hours 121.5

- ¹ For students completing the language requirement via the 3+1 language option, note that many first semester languages are 5 credit hours.
- ² CHEM 130 requires MATH 115 eligibility for enrollment.
- ³ Majors are required to complete a minimum of 5 hours of 300+ level electives in Physics or Astronomy.
- ⁴ Course timing is interchangeable between junior and senior years and is dependent on course offering/availability. ASTR 591 is taught in fall semesters of odd-numbered years and ASTR 592 is taught in spring semesters of even-numbered years.
- ⁵ Hour requirements (incl. 45 jr/sr hrs) are typically met through KU 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.

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

** - This course is a <u>Recommended</u> 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 <u>Required</u> 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 & 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 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 planning 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.