

# Bachelor of Arts in Physics

## 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 Physics and Astronomy

We welcome all students curious about the universe around them. This includes not only students planning on graduate study in STEM, but also students from other disciplines where a background in foundational physical science and critical thinking can be useful – teaching, medicine, e.g. – and anyone seeking to include astronomy and physics as part of their general education. The department offers BA degrees in astronomy and physics and BS degrees in astronomy, physics, and engineering physics; degrees in astronomy and physics are granted through the College of Liberal Arts and Sciences whereas engineering physics degrees are granted through the School of Engineering. The BS physics degree includes an interdisciplinary track that allows students to take elective courses in other STEM disciplines and a pre-medicine emphasis for students interested in health professions. We also offer minors in astronomy and physics and a certificate in astrophysics of origins. We involve our undergraduate majors in cutting-edge research practically from the day they join the department; research is a requirement of both the BS Astronomy and BS Physics degrees. The breadth of our research program affords our students exposure to a number of different fields and we are justifiably proud of our undergraduate researchers who routinely publish papers, attend conferences, and/or conduct research abroad (in Antarctica, Chile, CERN, e.g.).

## Undergraduate Admission

### Admission to KU

All students applying for admission must send high school and college transcripts to the Office of Admissions. Unless they are college transfer students with at least 24 hours of credit, prospective students must send ACT or SAT scores 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 Admissions (<http://credittransfer.ku.edu>) website.

## Admission to the College of Liberal Arts and Sciences

Admission to the College is a different process from admission to a major field. Some CLAS departments have admission requirements. See individual department/program sections for departmental admission requirements.

## Requirements for the B.A. Major in Physics

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

## Bachelor of Arts in Physics Major Course Requirements

Code	Title	Hours
<b>Foundational Physics and Mathematics</b>		
Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. All honors equivalents are also acceptable to fulfill PHSX major requirements.		
Seminar in Physics, Astronomy, & Engineering Physics. Satisfied by:		0
PHSX 150	Seminar in Physics, Astronomy and Engineering Physics	0.5
General Physics I. Satisfied by one of the following:		0
PHSX 211 & PHSX 216	General Physics I and General Physics I Laboratory	5
PHSX 213	General Physics I Honors	5
General Physics II. Satisfied by one of the following:		0
PHSX 212 & PHSX 236	General Physics II and General Physics II Laboratory	4
PHSX 214	General Physics II Honors	4
Calculus I. Satisfied by:		
MATH 125	Calculus I	4
	or MATH 145 Calculus I, Honors	
Calculus II. Satisfied by:		
MATH 126	Calculus II	4
	or MATH 146 Calculus II, Honors	
<b>Advanced Math Requirement</b>		0
MATH 127	Calculus III	4
	or MATH 147 Calculus III, Honors	
Elementary Linear Algebra. Satisfied by:		
MATH 290	Elementary Linear Algebra	2
	or MATH 291 Elementary Linear Algebra, Honors	
<b>Differential Equations. Satisfied by one of the following:</b>		3

MATH 220	Applied Differential Equations	
	or MATH 22 Applied Differential Equations, Honors	
MATH 320	Elementary Differential Equations (recommended)	

### Advance Physics Major Requirements

Majors must complete a course in each of the following areas:

General Physics III. Satisfied by:		
PHSX 313	General Physics III	3
Intermediate Physics Lab. Satisfied by:		
PHSX 316	Intermediate Physics Laboratory I	1
Introductory Quantum Mechanics. Satisfied by:		
PHSX 511	Introductory Quantum Mechanics	3
Mechanics I. Satisfied by:		
PHSX 521	Mechanics I	3
Electricity and Magnetism. Satisfied by:		
PHSX 531	Electricity and Magnetism	3
Advanced Physics Lab. Satisfied by one of the following:		
PHSX 536	Electronic Circuit Measurement and Design	4
	or PHSX 516 Physical Measurements	

### Physics Required Elective

Satisfied by any lecture or laboratory course numbered 500 or higher. 3

## Physics 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 30 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 (<http://clas.ku.edu/undergrad/tools/gpa>).

## Concentration in Computational Physics

Code	Title	Hours
<b>Physics Prerequisite or Co-requisite Knowledge</b>		
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.		
Programming I. Satisfied by:		
EECS 168	Programming I	4
	or EECS 169 Programming I: Honors	
Programming II. Satisfied by:		
EECS 268	Programming II	4
Elementary Linear Algebra. Satisfied by:		
MATH 290	Elementary Linear Algebra	2
	or MATH 291 Elementary Linear Algebra, Honors	

	or MATH 590 Linear Algebra	
Elementary or Applied Differential Equations. Satisfied by:		
MATH 220	Applied Differential Equations	3
	or MATH 221 Applied Differential Equations, Honors	
	or MATH 320 Elementary Differential Equations	
Foundations of Chemistry I. Satisfied by:		
CHEM 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	
Principles of Biology. Satisfied by:		
BIOL 100	Principles of Biology	3
Introduction to Symbolic Logic. Satisfied by:		
PHIL 310	Introduction to Symbolic Logic	3
Economics. Satisfied by:		
ECON 142	Principles of Microeconomics	3
	or ECON 143 Principles of Microeconomics, Honors	
	or ECON 144 Principles of Macroeconomics	
	or ECON 145 Principles of Macroeconomics, Honors	

### Physics Core Knowledge and Skills

Majors must complete a course in each of the following areas:

Seminar in Physics, Astronomy, and Engineering Physics. Satisfied by:		
PHSX 150	Seminar in Physics, Astronomy and Engineering Physics	
General Physics I. Satisfied by one of the following:		
PHSX 211	General Physics I	5
	& PHSX 216 and General Physics I Laboratory	
	PHSX 213 General Physics I Honors	
General Physics II. Satisfied by one of the following:		
PHSX 212	General Physics II	
	& PHSX 236 and General Physics II Laboratory	
	PHSX 214 General Physics II Honors	
General Physics III and Intermediate Physics Laboratory. Satisfied by:		
PHSX 313	General Physics III	4
	& PHSX 316 and Intermediate Physics Laboratory I	
Mechanics I. Satisfied by:		
PHSX 521	Mechanics I	3
Electricity and Magnetism. Satisfied by:		
PHSX 531	Electricity and Magnetism	3
Advanced Physics Lab. Satisfied by one of the following:		
PHSX 536	Electronic Circuit Measurement and Design	4
	or PHSX 516 Physical Measurements	
Special Problems. Satisfied by:		
PHSX 500	Special Problems	5
Numerical and Computational Methods in Physics. Satisfied by:		
PHSX 615	Numerical and Computational Methods in Physics	3

Below is a sample 4-year plan for students pursuing the BA in Physics. To view the list of courses approved to fulfill KU Core Goals, please visit the KU Core website (<http://kucore.ku.edu/courses>).

This degree plan assumes students will have the equivalent of MATH 101 or MATH 104 prior to freshman year, fall semester.

**Freshman**

Fall	Hours Spring	Hours
MATH 125 (Major Pre-requisite)	4 MATH 126 (Major Pre-requisite)	4
ENGL 101 (Goal 2.1 (2 crs req), BA Writing I) <sup>1</sup>	3 PHSX 211 & PHSX 216 (Goal 3 Natural Science, Major Requirement), or	5
PHSX 150 (Major Requirement)	0.5 PHSX 213	
CHEM 130	5 Elective/KU Core	6
Elective/KU Core	3	
15.5		15

**Sophomore**

Fall	Hours Spring	Hours
PHSX 212 & PHSX 236 (Major Requirement), or	4 PHSX 313 (Major Requirement) <sup>3</sup>	3
PHSX 214	PHSX 316 (Major Requirement)	1
MATH 127	4 MATH 220 or 320	3
MATH 290	2 2nd Semester Language (BA Second Language)	5
Elective/KU Core	3 Elective/KU Core or possible minor course (Total Hours)	3
1st Semester Language (BA Second Language)	5	
18		15

**Junior**

Fall	Hours Spring	Hours
PHSX 521	3 PHSX 511	3
3rd Semester Language (BA Second Language)	3 4th Semester Language (BA Second Language)	3
Elective/KU Core or possible minor course 300+ (Total Hours)	9 Elective or possible minor course 300+ (Total Hours)	6
	PHSX 536 (or Elective/KU Core)	4
15		16

**Senior**

Fall	Hours Spring	Hours
PHSX 531 (Major Requirement)	3 PHSX Lecture or Lab Elective 500+ (Major Requirement) <sup>5</sup>	3
PHSX 516 or 536 (or Elective/KU Core) <sup>4</sup>	4 Elective/KU Core or possible minor course 300+ (Total Hours)	12
Elective/KU Core or possible minor course 300+ (Total Hours)	9	
16		15

Total Hours 125.5

- <sup>1</sup> The BA requires completion of two courses of collegiate-level writing instruction. Students who test out of Composition will still need to complete ENGL 102 (or equivalent) and one additional Goal 2.1 course.
- <sup>2</sup> Prerequisite for MATH 125: MATH 104; or MATH 103; or three years of college preparatory mathematics including trigonometry and a score of 28 or higher on ACT mathematics; or a qualifying score on the mathematics placement test.
- <sup>3</sup> MATH 320 or MATH 220 (or MATH 221) is a pre-requisite for PHSX 313.
- <sup>4</sup> Either PHSX 536 or PHSX 516 is required for the major, not both. PHSX 516 is typically taught in the fall, and PHSX 536 is often taught in the spring.
- <sup>5</sup> A 500+ level Physics laboratory or lecture elective is required for the major.
- <sup>6</sup> It is recommended that students fulfill Goal 6 with a course from within their major. PHSX 503: Undergraduate Research is not required by the major, but is an encouraged course to fulfill Goal 6 and to fulfill research experience.
- <sup>7</sup> Visit this website (<https://collegeadvising.ku.edu/sites/collegeadvising.ku.edu/files/docs/BA.QuantitativeReasoning.pdf>) for a list of courses that fulfill the BA Quantitative Reasoning requirement.

Please note:

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

The same course cannot be used to fulfill more than one KU Core Goal. However, overlap of a KU Core course with a major or degree-specific requirement is allowed. Overlapping is recommended to allow more opportunities to explore other majors and/or minors.

## 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 3.25 overall and 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 597, ASTR 503, PHSX 501 or PHSX 503. A grade of B or better must be earned in one of the following: ASTR 597, ASTR 503, PHSX 501 or PHSX 503. In addition, all of our department's honors requirements include student research, for which results shall be presented in at least one of the following forms: (1) a written research summary, read by 3 faculty members in physics and astronomy or related fields or authorship on a peer-reviewed manuscript; (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.

A student who plans to graduate with honors in physics and astronomy must file a Declaration of Intent Form with the Departmental Honors Coordinator, preferably during his/her junior year but in any case no later than enrollment for the final undergraduate semester.