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 careers 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 program 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 – examples include teaching and medicine – 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 primary degree offered is a BS in Physics. In addition to this standard BS in Physics, there are also interdisciplinary and pre-medicine versions (specializations) of the BS in Physics degree. The interdisciplinary track allows students to take elective courses in other STEM disciplines and the pre-medicine emphasis is 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 locales such as Antarctica, Chile, and CERN).

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 Admissions (http://credittransfer.ku.edu/) website.

Requirements for the B.S. Degree in Physics

Physics Bachelor of Science (B.S.) General Education Requirements

All students pursuing the Bachelor of Science in Physics must complete the KU Core requirements in addition to the degree and major requirements. For details regarding the KU Core requirements, please see the KU Core section of the catalog.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tr>
<td><strong>Foundational Physics and Mathematics</strong></td>
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<td>Calculus I</td>
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<td>MATH 125</td>
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<td>or MATH 145</td>
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<td>Seminar in Physics, Astronomy, &amp; Engineering Physics. Satisfied by:</td>
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<td>PHSX 150</td>
<td>Seminar in Physics, Astronomy and Engineering Physics</td>
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<td>or PHSX 211: General Physics I Honors</td>
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<td><strong>General Science Requirements</strong></td>
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<td>CHEM 130</td>
<td>General Chemistry I</td>
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<td>or CHEM 150</td>
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<td>or CHEM 170</td>
<td>Chemistry for the Chemical Sciences I</td>
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<td>or CHEM 190</td>
<td>Foundations of Chemistry I, Honors</td>
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<td>&amp; CHEM 191</td>
<td>and Foundations of Chemistry I Laboratory, Honors</td>
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<td><strong>Advanced Mathematics</strong></td>
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<td>MATH 127</td>
<td>Calculus III</td>
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<td>or MATH 147</td>
<td>Calculus III, Honors</td>
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<td>Elementary Linear Algebra. Satisfied by:</td>
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<td>Elementary Linear Algebra</td>
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or MATH 291 Elementary Linear Algebra, Honors
or MATH 590 Linear Algebra

Differential Equations. Satisfied by:
MATH 320 Elementary Differential Equations 3
or MATH 220 Applied Differential Equations
or MATH 221 Applied Differential Equations, Honors

Advanced Physics
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 611 Introductory Quantum Mechanics 3
Mechanics I. Satisfied by:
PHSX 521 Mechanics I 3
Electricity and Magnetism. Satisfied by:
PHSX 531 Electricity and Magnetism 3
Thermal Physics. Satisfied by:
PHSX 671 Thermal Physics 3

Undergraduate Research or Honors Research. Satisfied by:
PHSX 503 Undergraduate Research 1-4
or PHSX 501 Honors Research 1

Required Electives (Majors must complete one of the following options, Standard, Interdisciplinary, or Pre-Medicine)

BS in Physics, Standard Specialization 26-27
Computing and Programming. Satisfied by both of the following:
EECS 138 Introduction to Computing: ______
or EECS 168 Programming I
or EECS 169 Programming I: Honors
PHSX 315 Introduction to Computation for Physics and Astronomy

Mechanics II. Satisfied by:
PHSX 621 Mechanics II

Electromagnetic Theory. Satisfied by:
PHSX 631 Electromagnetic Theory

Quantum Mechanics. Satisfied by:
PHSX 711 Quantum Mechanics I

Advanced Physics Labs. Satisfied by both of the following:
PHSX 536 Electronic Circuit Measurement and Design
PHSX 616 Physical Measurements

Advanced Physics. Satisfied by two of the following:
PHSX 621 Mechanics II
PHSX 631 Electromagnetic Theory
PHSX 711 Quantum Mechanics I

PHSX 536 Electronic Circuit Measurement and Design 1
PHSX 616 Physical Measurements 1

Physics Elective. Satisfied by any PHSX lecture or laboratory course numbered 500 or higher and not part of the other specific requirements for the major.

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 530 Mathematical Models

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

BS in Physics, Interdisciplinary Specialization 25-30
Computing and Programming. Satisfied by both of the following:
EECS 138 Introduction to Computing: ______
or EECS 168 Programming I
or EECS 169 Programming I: Honors
PHSX 315 Introduction to Computation for Physics and Astronomy

Advanced Physics Labs. Satisfied by one of the following:
PHSX 536 Electronic Circuit Measurement and Design
PHSX 616 Physical Measurements

Advanced Physics. Satisfied by two of the following:
PHSX 621 Mechanics II
PHSX 631 Electromagnetic Theory
PHSX 711 Quantum Mechanics I

PHSX 536 Electronic Circuit Measurement and Design 1
PHSX 616 Physical Measurements 1

Physics Elective. Satisfied by any PHSX lecture or laboratory course numbered 500 or higher and not part of the other specific requirements for the major.

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 530 Mathematical Models

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

Allied Science Fields. Satisfied by the completion of 2 advanced courses in 1 allied science field chosen from the following:

Biology. Satisfied by two of the following:
BIOL 400 Fundamentals of Microbiology
BIOL 412 Evolutionary Biology
BIOL 416 Cell Structure and Function
BIOL 595 Human Genetics

BIOL 600 Introductory Biochemistry, Lectures
BIOL 636 Biochemistry I
BIOL 638 Biochemistry II
BIOL 546 Mammalian Physiology

Chemistry. Satisfied by two of the following:
CHEM 598 Research Methods (UKanTeach students only)
CHEM 330  Organic Chemistry I
CHEM 335  Organic Chemistry II
CHEM 530  Physical Chemistry I
CHEM 535  Physical Chemistry II

Geology. Satisfied by two of the following:
- GEOL 360  Field Investigation
- GEOL 562  Structural Geology
- GEOL 575  Seismic Exploration

Electrical Engineering and Computer Science. Satisfied by two of the following:
- EEECS 622  Microwave and Radio Transmission Systems
- EEECS 628  Fiber Optic Communication Systems
- EEECS 670  Introduction to Semiconductor Processing
- EEECS 713  High-Speed Digital Circuit Design
- EEECS 721  Antennas
- EEECS 728  Fiber-optic Measurement and Sensors

**BS in Physics, Pre-Medicine Specialization**

**CHEM 520**  Physical Chemistry. Satisfied by:
- CHEM 336
- CHEM 335
- CHEM 330

**CHEM 135**  Organic Chemistry I

**CHEM 17**  General Chemistry I

**CHEM 331**  Organic Chemistry I Laboratory

**CHEM 335**  Organic Chemistry II Laboratory

**CHEM 336**  Organic Chemistry II Laboratory

**CHEM 520**  Biological Physical Chemistry with Laboratory
- CHEM 539  Physical Chemistry I
- CHEM 537  Physical Chemistry Laboratory

**BIOL 600**  Introductory Biochemistry, Lectures

**BIOL 150**  Principles of Molecular and Cellular Biology

**BIOL 152**  Principles of Organismal Biology

**BIOL 154**  Introductory Biology Lab for STEM Majors

**BIOL 240**  Fundamentals of Human Anatomy or BIOL 546  Mammalian Physiology

**BIOL 350**  Principles of Genetics

**BIOL 400**  Fundamentals of Microbiology

**BIOL 503**  Immunology

**Biochemistry. Satisfied by the following:**
- BIOL 600  Introductory Biochemistry, Lectures

**CHEM 135**  General Chemistry II
- CHEM 17  Chemistry for the Chemical Sciences II
- CHEM 19  Foundations of Chemistry II, Honors
- CHEM 19H  and Foundations of Chemistry II Laboratory, Honors

**Organic Chemistry. Satisfied by:**
- CHEM 330  Organic Chemistry I
- CHEM 331  Organic Chemistry I Laboratory
- CHEM 335  Organic Chemistry II
- CHEM 336  Organic Chemistry II Laboratory

**Physical Chemistry. Satisfied by:**
- CHEM 520  Biological Physical Chemistry with Laboratory
- CHEM 539  Physical Chemistry I
- CHEM 537  Physical Chemistry Laboratory

**BIOL 150**  Principles of Molecular and Cellular Biology

**MATH, or PHSX Elective (above 400 level)**

**Additional Requirements**
- SOC 104  Elements of Sociology Also satisfies KU Core Goal 4.1
- or SOC 105  Elements of Sociology, Honors
- PSYC 104  General Psychology Also satisfies KU Core Goal 3.3

1 This course will not count as one of the two Advanced Physics Courses if it has already counted toward the one required Advanced Physics Lab.

**Physics Major Hours & Major GPA**

While completing all required courses, 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 2.0 KU GPA in junior/senior courses (300+) in the major.

**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 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.