Bachelor of Science 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 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 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 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. 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.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.

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<tr>
<th>Code</th>
<th>Title</th>
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<tr>
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<td>Foundational Physics and Mathematics</td>
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<td>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. These hours do not contribute to the minimum number of hours required for the major.</td>
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<td>Calculus I. Satisfied by:</td>
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<td>MATH 125</td>
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<td>or MATH 145</td>
<td>Calculus I, Honors</td>
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<td>MATH 126</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 212</td>
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<td>General Science Requirements</td>
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<td></td>
<td>CHEM 130</td>
<td>General Chemistry I</td>
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<td>or CHEM 150</td>
<td>Chemistry for Engineers</td>
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<td>or CHEM 170</td>
<td>Chemistry for the Chemical Sciences</td>
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or CHEM 190  Foundations of Chemistry I, Honors
& CHEM 191  and Foundations of Chemistry I Laboratory, Honors

**Advanced Mathematics**

Vector Calculus. Satisfied by:
MATH 127  Calculus III 4
or MATH 147  Calculus III, Honors

Elementary Linear Algebra. Satisfied by:
MATH 290  Elementary Linear Algebra 2-3
or MATH 291  Elementary Linear Algebra, Honors
or MATH 590  Linear Algebra

Differential Equations. Satisfied by:
MATH 320  Elementary Differential Equations 3

**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 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

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

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

25-45

**Preprofessional Option**

26-27

Computing and Programming. Satisfied by:
EECS 138  Introduction to Computing: ______
or EECS 168 Programming I
or EECS 168 Programming I: Honors

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 516  Physical Measurements
PHSX 536  Electronic Circuit Measurement and Design

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 except MATH 701 and MATH 715

**Interdisciplinary Option**

25-30

Computing and Programming. Satisfied by:
EECS 138  Introduction to Computing: ______
or EECS 168 Programming I
or EECS 168 Programming I: Honors

Advanced Physics Labs. Satisfied by one of the following:
PHSX 516  Physical Measurements
PHSX 536  Electronic Circuit Measurement and Design

Advanced Physics. Satisfied by two of the following:
PHSX 621  Mechanics II
PHSX 631  Electromagnetic Theory
PHSX 711  Quantum Mechanics I
PHSX 516  Physical Measurements
PHSX 536  Electronic Circuit Measurement and Design

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 except MATH 701 and MATH 715

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
### Pre-Medicine Option

- **CHEM 336**
- **CHEM 335**
- **CHEM 331**
- **CHEM 330**

- **Organic Chemistry**
  - Satisfied by: **CHEM 135**

- **General Chemistry II**
  - Satisfied by: **BIOL 601**
  - **BIOL 600**
  - **BIOL 575**

- **Advanced Biology**
  - Satisfied by: **BIOL 595**

- **Biological Physical Chemistry with Laboratory**
  - or **CHEM 531: Physical Chemistry I** & **CHEM 533: and Physical Chemistry Laboratory**

- **Social Science Courses (recommended but not required):** Both courses satisfy KU Core Goal 3.
  - **SOC 104** Elements of Sociology
  - **SOC 105** Elements of Sociology, Honors

- **Physical Chemistry**
  - Satisfied by (above 400 level)
  - **BIOL, MATH,** or **PHSX Elective**

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

### Pre-Medicine Option

- **Advanced Physics Labs.** Satisfied by one of the following:
  - **PHSX 516** Physical Measurements
  - **PHSX 536** Electronic Circuit Measurement and Design

- **Introductory Biology.**
  - Satisfied by the following:
    - **BIOL 150** Principles of Molecular and Cellular Biology
    - **BIOL 152** Principles of Organismal Biology

- **Genetics.** Satisfied by the following:
  - **BIOL 350** Principles of Genetics
  - **BIOL 595** Human Genetics

- **Advanced Biology.**
  - Satisfied by:
    - **BIOL 400** Fundamentals of Microbiology
    - **BIOL 503** Immunology
    - **BIOL 546** Mammalian Physiology

- **Biochemistry.** Satisfied by the following:
  - **BIOL 600** Introductory Biochemistry, Lectures
  - **BIOL 601** Principles of Biochemistry Laboratory
  - **BIOL 636** Biochemistry I
  - **BIOL 637** Introductory Biochemistry Laboratory

- **General Chemistry II.**
  - Satisfied by:
    - **CHEM 135** General Chemistry II
    - or **CHEM 176:** Chemistry for the Chemical Sciences II
    - or **CHEM 195:** Foundations of Chemistry II, Honors
    - & **CHEM 196:** 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

### 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.
  - 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/](http://clas.ku.edu/undergrad/tools/gpa/)).

### 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 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 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.
year but in any case no later than enrollment for the final undergraduate semester.