

# PHYSICS, B.S.

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Study the nature of matter, energy and spacetime at the most fundamental level with Saint Louis University's B.S. in Physics. Physics provides a foundation for all the natural sciences and engineering disciplines. Physics has brought such revolutions as relativity, quantum mechanics and the Big Bang theory, profoundly altering the way mankind views the universe.

Physicists have played a major role in the discovery of many phenomena leading to whole new technologies. The invention of the transistor, by physicists, has made the modern computer possible, while the development of lasers has led to diverse applications ranging from supermarket scanners to laser surgery. The physicist is a versatile problem solver and able to excel in many technical fields.

A training in physics leads to a broad-based understanding of natural phenomena, analytical and computer skills, experience with electronics and the operation of sophisticated equipment, an understanding of measurements and their limitations, and the ability to formulate and solve technical problems.

Physics students have a strong interest in mathematics, computers and science along with a desire to understand how the universe works. Students are interested in questions such as "Why do elementary particles behave the way they do?" or "What is the nature of light?" or "How did the universe begin, and what will eventually happen to it?" Some students pursue double majors in mathematics, computer science or an engineering field.

## Curriculum Overview

The B.S. in physics stresses physics and its applications in areas such as engineering, computers and the sciences, and also includes opportunities to participate in faculty research.

Students of the physics program gain a solid foundation in analytical, computational and laboratory skills through course work in mathematics, computer science and physics. The physics curriculum includes courses in classical mechanics, quantum mechanics, electricity and magnetism, thermodynamics and statistical mechanics, as well as optics, electronics and modern physics.

## Fieldwork and Research Opportunities

Benefits of the physics program also include several internship and career opportunities. The physics department employs some of its students as teaching and research assistants during the summer. Students have held summer internships at NASA-Langley, the Argonne National Laboratory and other laboratories. Students have worked both during the summer and during the year at local industries such as Boeing and Anheuser-Busch. Numerous opportunities exist for summer research in basic and applied physics in Parks College, national laboratories, and National Science Foundation-sponsored programs at universities throughout the United States.

The programs stress undergraduate research and applications of computers in physics. New state-of-the-art research facilities allow for students to work directly alongside faculty members on research projects.

## Careers

Graduates with a bachelor's degree in physics enter a variety of careers that depend on the technical skills gained in college. Alumni are employed in product development and quality control in large industries such as RCA, Boeing or Lockheed-Martin. Alumni are computer specialists at Anheuser-Busch and other companies. Some are now involved in the marketing of technical products, while others are in management positions. A few graduates have entered military careers. Students frequently earn double majors, combining physics with mathematics, computer science or chemistry.

## Admission Requirements

### Begin Your Application (<http://www.slu.edu/apply.php>)

Saint Louis University also accepts the Common Application.

### Freshman

All applications are thoroughly reviewed with the highest degree of individual care and consideration to all credentials that are submitted. Solid academic performance in college preparatory coursework is a primary concern in reviewing a freshman applicant's file.

To be considered for admission to any Saint Louis University undergraduate program, applicants must be graduating from an accredited high school, have an acceptable HiSET exam score or take the General Education Development (GED) test.

### Transfer

Applicants must be a graduate of an accredited high school or have an acceptable score on the GED.

Students who have attempted fewer than 24 semester credits (or 30 quarter credits) of college credit must follow the above freshmen admission requirements. Students who have completed 24 or more semester credits (or 30 quarter credits) of college credit must submit transcripts from all previously attended college(s).

In reviewing a transfer applicant's file, the Office of Admission holistically examines the student's academic performance in college-level coursework as an indicator of the student's ability to meet the academic rigors of Saint Louis University. Where applicable, transfer students will be evaluated on any courses outlined in the continuation standards of their preferred major.

### International Applicants

All admission policies and requirements for domestic students apply to international students along with the following:

- Demonstrate English Language Proficiency
- Proof of financial support must include:
  - A letter of financial support from the person(s) or sponsoring agency funding the time at Saint Louis University
  - A letter from the sponsor's bank verifying that the funds are available and will be so for the duration of study at the University
- Academic records, in English translation, of students who have undertaken postsecondary studies outside the United States must include the courses taken and/or lectures attended, practical laboratory work, the maximum and minimum grades attainable, the grades earned or the results of all end-of-term examinations, and any honors or degrees received. WES and ECE transcripts are accepted.

## Additional Admission Requirements

In addition to the general admission and matriculation requirements of the University, the B.S. in Physics program has the following additional requirements:

- **GPA:** Minimum cumulative 3.00 high school GPA for freshmen applicants and 2.70 college GPA for transfer applicants.
- **Coursework:** Fifteen total units of high school work are required: three or four units of English; four or more units of mathematics including algebra I and II, geometry and precalculus (Algebra II with Trigonometry is not sufficient). Students should be prepared to start the first semester freshmen year in Calculus I or higher; three or four units of science including general science, introduction to physical science, earth science, biology, physics or chemistry; two or three units of social sciences including history, psychology or sociology; and three units of electives.

Admission requirements to Parks College of Engineering, Aviation and Technology degree programs are based on a combination of secondary school grades, college admission test scores, co-curricular activities and attempted college course work, as well as other indicators of the applicant's ability, career focus and character. This process respects the non-discrimination policy of the University and is designed to select a qualified, competent and diverse student body with high standards of scholarship and character, consistent with the mission of the University.

## Scholarships and Financial Aid

There are two principal ways to help finance a Saint Louis University education:

- **Scholarships:** Scholarships are awarded based on academic achievement, service, leadership and financial need.
- **Financial Aid:** Financial aid is provided in the form of grants and loans, some of which require repayment.

For priority consideration for merit-based scholarships, apply for admission by Dec. 1 and complete a Free Application for Federal Student Aid (FAFSA) by March 1.

For information on other scholarships and financial aid, visit the student financial services office online at <https://www.slu.edu/financial-aid> (<https://www.slu.edu/financial-aid/>).

## Learning Outcomes

1. Graduates will be able to understand the principles of physics and apply these principles to problems of fundamental and practical interest.
2. Graduates will be able to design and conduct experiments and analyze and interpret data.
3. Graduates will be able to collaborate effectively on teams.
4. Graduates will be able to communicate effectively and professionally in oral and written formats.
5. Graduates will be able to know about contemporary issues in science and technology.
6. Graduates will be able to understand the numerical formulation of scientific problems and be able to solve such problems utilizing at least one programming language or environment.

## Requirements

Physics students must complete a minimum total of **80 credits** for the major.

Code	Title	Credits
<b>Core Requirements</b>		
College core requirements (p. 3)		54-60
For additional information about core courses		
<b>Prerequisites</b>		
CHEM 1110 & CHEM 1115	General Chemistry 1 and General Chemistry 1 Laboratory	4
CHEM 1120 & CHEM 1125	General Chemistry 2 and General Chemistry 2 Laboratory	4
PHYS 1110	Introduction to Physics (as a career)	1
PHYS 1610 & PHYS 1620	University Physics I and University Physics I Laboratory	4
PHYS 1630 & PHYS 1640	University Physics II and University Physics II Laboratory	4
MATH 1510	Calculus I	4
MATH 1520	Calculus II	4
MATH 2530	Calculus III	4
CSCI 1060	Introduction to Computer Science: Scientific Programming	3
<b>Required Physics &amp; Mathematics Courses</b>		
MATH 3240	Numerical Analysis	3
MATH 3270	Advanced Mathematics for Engineers	3
MATH 3550	Differential Equations	3
MATH 3850	Foundation of Statistics	3
PHYS 2610	Modern Physics	3
PHYS 2620	Modern Physics Lab	1
PHYS 3110	Classical Mechanics	3
PHYS 3610	Atomic, Molecular and Solid-State Physics	3
PHYS 4210	Electricity & Magnetism I	3
PHYS 4610	Quantum Mechanics	3
PHYS 3310 & PHYS 3320	Optics and Optics Laboratory	4
PHYS 3410	Thermodynamics and Statistical Mechanics	3
PHYS 3510 & PHYS 3511	Analog & Digital Electronics and Analog & Digital Electronics Lab	4
<b>Additional Requirements</b>		
Select two additional upper division physics courses (minimum six credits) from the following:		6
PHYS 3120	Advanced Classical Mechanics	
PHYS 4220	Electricity & Magnetism II	
PHYS 4620	Application of Quantum Mechanics	
<b>Research Experience</b>		
PHYS 3860	Physics Research I	0
PHYS 4870	Physics Research II	0
PHYS 4880	Senior Inquiry: Research Project	3
<b>Total Credits</b>		<b>134-140</b>

## Bachelor of Science Core Curriculum Requirements

**Code Title Credits**

Please note: beginning in Fall 2022, all incoming SLU undergraduates –regardless of major, program, college or school–will complete the University Core curriculum. You can find more information about SLU's common Core here: <https://www.slu.edu/core/index.php> (<https://www.slu.edu/core/>)

### Core Components and Credits

Foundations of Discourse	3
Diversity in the U.S.	3
Global Citizenship	3
Foreign Language	0-6
Fine Arts	3
Literature	6
Mathematics	4
Science	8
Philosophy	6
Social Science	6
Theology	6
World History	6
<b>Total Credits</b>	<b>54-60</b>

### Graduation Requirements

- Complete a minimum of 120 credits (excluding pre-college level courses numbered below 1000).
- Complete either the College of Arts and Sciences Bachelor of Arts or Bachelor of Science Core Curriculum Requirements.
- Complete major requirements: minimum 30 credits required.
- Complete remaining credits with a second major, minor, certificate, and/or electives to reach the minimum of 120 credits required for graduation.
- Achieve at least a 2.00 cumulative grade point average, a 2.00 grade point average in the major(s) and a 2.00 grade point average in the minor/certificate, or related elective credits.
- Complete department/program-specific academic and performance requirements.
- Complete at least 50% of the coursework for the major and 75% for the minor/certificate through Saint Louis University or an approved study abroad program.
- Complete 30 of the final 36 credits through Saint Louis University or an approved study abroad program.
- Complete an online degree application by the required University deadline.

## Continuation Standards

Students must have a GPA of 2.00 in physics major/minor coursework to be retained in the major/minor.

## Roadmap

Roadmaps are recommended semester-by-semester plans of study for programs and assume full-time enrollment unless otherwise noted.

Courses and milestones designated as critical (marked with !) must be completed in the semester listed to ensure a timely graduation. Transfer credit may change the roadmap.

This roadmap should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor/mentor each semester. Requirements, course availability and sequencing are subject to change.

Course	Title	Credits
<b>Year One</b>		
<b>Fall</b>		
PHYS 1110	Introduction to Physics	1
CHEM 1110 & CHEM 1115	General Chemistry 1 and General Chemistry 1 Laboratory	4
MATH 1510	Calculus I	4
A & S Core		3
A & S Core		3
<b>Credits</b>		<b>15</b>
<b>Spring</b>		
PHYS 1610 & PHYS 1620	University Physics I and University Physics I Laboratory	4
MATH 1520	Calculus II	4
CHEM 1120 & CHEM 1125	General Chemistry 2 and General Chemistry 2 Laboratory	4
A & S Core		3
<b>Credits</b>		<b>15</b>
<b>Year Two</b>		
<b>Fall</b>		
PHYS 1630 & PHYS 1640	University Physics II and University Physics II Laboratory	4
MATH 2530	Calculus III	4
CSCI 1060	Introduction to Computer Science: Scientific Programming	3
A & S Core		3
<b>Credits</b>		<b>14</b>
<b>Spring</b>		
PHYS 2610 & PHYS 2620	Modern Physics and Modern Physics Lab	4
PHYS 3110	Classical Mechanics	3
MATH 3550	Differential Equations	3
MATH 3240	Numerical Analysis	3
A & S Core		3
<b>Credits</b>		<b>16</b>
<b>Year Three</b>		
<b>Fall</b>		
PHYS 4610	Quantum Mechanics	3
MATH 3270	Advanced Mathematics for Engineers	3
A & S Core		3
PHYS 3610	Atomic, Molecular and Solid-State Physics	3
A & S Core		3
<b>Credits</b>		<b>15</b>
<b>Spring</b>		
PHYS 4210	Electricity & Magnetism I	3
PHYS 3410	Thermodynamics and Statistical Mechanics	3
PHYS 3860	Physics Research I	0
PHYS Upper Division Course <sup>1</sup>		3

MATH 3850	Foundation of Statistics	3
A & S Core		3
A & S Core		3
<b>Credits</b>		<b>18</b>
<b>Year Four</b>		
<b>Fall</b>		
PHYS 3510	Analog & Digital Electronics	4
& PHYS 3511	and Analog & Digital Electronics Lab	
PHYS Upper Division Course <sup>1</sup>		3
PHYS 4870	Physics Research II	0
A & S Core		3
A & S Core		3
A & S Core		3
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
PHYS 4880	Senior Inquiry: Research Project	3
PHYS 3310	Optics	4
& PHYS 3320	and Optics Laboratory	
PHYS Upper Division Course <sup>1</sup>		3
A & S Core		3
A & S Core		3
<b>Credits</b>		<b>16</b>
<b>Total Credits</b>		<b>125</b>

<sup>1</sup> Two additional courses can be selected from the following for PHYS Upper Division Course: PHYS 3120 Advanced Classical Mechanics (3 cr), PHYS 4220 Electricity & Magnetism II (3 cr), PHYS 4620 Application of Quantum Mechanics (3 cr).