

Department of Physics and Astronomy

The degree programs offered by the Department of Physics and Astronomy reflect its policy of offering the opportunity for a comprehensive education of the highest quality, individualized to the needs and interests of the students. Completion of a Bachelor's degree in Physics allows students entry into one of the highly specialized areas in science and technology, and the ability to apply for positions in industry and government, as well as entry into professional and graduate schools.

- B.S. degree in Physics (p. 1)
- B.A. degree in Physics (p. 2)

Bachelor of Science Degree in Physics

The Bachelor of Science (B.S.) degree in Physics provides opportunities for preparation for careers in industry and governmental agencies and for graduate study in physics or related fields.

The minimum number of semester credit hours required for this degree, including the Core Curriculum requirements, is 120. At least 39 of the total semester credit hours required for the degree must be at the upper-division level. All major and support work courses (including math, chemistry and computer science courses) must be completed with a grade of "C-" or better.

All candidates seeking this degree must fulfill the Core Curriculum requirements and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Physics must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both major requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

MAT 1214 may be used to satisfy the core requirement in Mathematics as well as a major requirement. PHY 1943 and PHY 1963 may be used to satisfy the core requirement in Life and Physical Sciences as well as major requirements.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degrequirements/corecurriculumcomponentarearequirements>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3

Component Area Option	3
Total Credit Hours	42

Gateway Courses

Students pursuing the B.S. degree in Physics must successfully complete each of the following Gateway Courses with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major.

PHY 2103 & PHY 2111	Modern Physics and Modern Physics Laboratory
PHY 2823	Mathematical Physics I
PHY 3203	Classical Mechanics I

Degree Requirements

A. Physics and Astronomy courses

1. Required courses completed with a grade of "C-" or better		
PHY 1943 & PHY 1951	Physics for Scientists and Engineers I and Physics for Scientists and Engineers I Laboratory	4
PHY 1963 & PHY 1971	Physics for Scientists and Engineers II and Physics for Scientists and Engineers II Laboratory	4
PHY 2103 & PHY 2111	Modern Physics and Modern Physics Laboratory	4
PHY 2823	Mathematical Physics I	3
PHY 3203	Classical Mechanics I	3
PHY 3293	Thermal Physics	3
PHY 3343	Physics Research Laboratory	3
PHY 3423	Electricity and Magnetism	3
PHY 3443	Modern Optics	3
PHY 3513	Electrodynamics	3
PHY 3583	Mathematical Physics II	3
PHY 4263	Quantum Mechanics I	3
PHY 4423	Quantum Mechanics II	3
PHY 4983	Unifying Concepts in Physics	3
2. 9 additional approved semester credit hours selected from the following (a maximum of 6 hours from either PHY 4911-3 or PHY 4953 may apply to this requirement):		
AST 3013	Fundamentals of Astronomy	
AST 3023	Introduction to Astrophysics	
PHY 3143	Introduction to Computational Physics	
PHY 3313	Materials Physics	
PHY 3453	Lasers: Theory and Applications	
PHY 3603	Cosmology	
PHY 4013	Relativity: Special and General	
PHY 4203	Classical Mechanics II	
PHY 4563	Biophotonics	
PHY 4603	Crystallography and Materials Characterization	
PHY 4623	Nanotechnology	
PHY 4653	Introduction to Micro and Nanotechnology	
PHY 4703	Renewable Energy: Solar Energy Convertors	
PHY 4833	Molecular Biophysics	

PHY 4843	Condensed Matter Theory	
PHY 4911	Independent Study	
PHY 4953	Special Studies in Physics	
PHY 4993	Honors Research	

B. Required courses in the College of Sciences

1. Required courses (excluding physics)

CHE 1103	General Chemistry I	3
CHE 1113	General Chemistry II	3
CHE 1121	General Chemistry I Laboratory	1
CS 1063	Introduction to Computer Programming I	3
or CS 1173	Data Analysis and Visualization	
or CS 2073	Computer Programming with Engineering Applications	
MAT 1214	Calculus I	4
MAT 1224	Calculus II	4
MAT 2214	Calculus III	4
MAT 2233	Linear Algebra	3
MAT 3613	Differential Equations I	3

2. Additional approved courses in the College of Sciences 5

Total Credit Hours 87

Course Sequence Guide for B.S. Degree in Physics

This course sequence guide is designed to assist students in completing their UTSA undergraduate Physics degree requirements. *This is merely a guide and students must satisfy other requirements of this catalog and meet with their academic advisor for individualized degree plans.* Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

B.S. in Physics – Recommended Four-Year Academic Plan

First Year

Fall		Credit Hours
AIS 1203	Academic Inquiry and Scholarship (core)	3
CHE 1103 or 1143	General Chemistry I	3
CHE 1121	General Chemistry I Laboratory ¹	1
CS 1063, 1173, or 2073	Introduction to Computer Programming I	3
MAT 1214	Calculus I (core and major)	4
WRC 1013	Freshman Composition I (Q) (core)	3

Spring

CHE 1113 or 1153	General Chemistry II	3
MAT 1224	Calculus II	4
PHY 1943 & PHY 1951	Physics for Scientists and Engineers I (core and major)	4
WRC 1023	Freshman Composition II (Q) (core)	3

Second Year

Fall		
MAT 2214	Calculus III	4
MAT 2233	Linear Algebra	3

PHY 1963 & PHY 1971	Physics for Scientists and Engineers II (core and major)	4
POL 1013	Introduction to American Politics (core)	3

Spring

MAT 3613	Differential Equations I	3
PHY 2103 & PHY 2111	Modern Physics	4
PHY 2823	Mathematical Physics I	3
PHY 3203	Classical Mechanics I	3
American History core		3

Third Year

Fall

PHY 3293	Thermal Physics	3
PHY 3423	Electricity and Magnetism	3
PHY 3443	Modern Optics	3
PHY 3583	Mathematical Physics II	3
POL 1133 or 1213	Texas Politics and Society (core)	3

Spring

PHY 3343	Physics Research Laboratory	3
PHY 3513	Electrodynamics	3
PHY 4263	Quantum Mechanics I	3
Language, Philosophy & Culture core		3
Social & Behavioral Sciences core		3

Fourth Year

Fall

PHY 4423	Quantum Mechanics II	3
College of Sciences elective		3
Upper-division AST or PHY elective ²		3
Upper-division AST or PHY elective ²		3
American History core		3

Spring

PHY 4983	Unifying Concepts in Physics	3
College of Sciences elective		2
Upper-division AST or PHY elective ²		3
Creative Arts core		3
Component Area Option core		3

Total Credit Hours: 120.0

¹ This laboratory course includes a lecture component as indicated on the University Schedule of Classes.

² From section A.2. of degree requirements.

Note: Some courses are only offered once a year; Fall or Spring. Check with the Department of Physics and Astronomy for scheduling of courses.

Bachelor of Arts Degree in Physics

The Bachelor of Arts (B.A.) degree in Physics provides opportunities for careers in several professional fields. It is not recommended for students planning to pursue graduate studies in physics or related fields.

The minimum number of semester credit hours required for this degree, including the Core Curriculum requirements, is 120. Thirty-nine of the

total semester credit hours required for the degree must be at the upper-division level.

All majors in physics are required to complete all required and elective physics courses with a grade of "C-" or better.

All candidates seeking this degree must fulfill the Core Curriculum requirements and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.A. degree in Physics must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both degree requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

MAT 1214 may be used to satisfy the core requirement in Mathematics as well as a major requirement. PHY 1943 and PHY 1963 may be used to satisfy the core requirement in Life and Physical Sciences as well as major requirements.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degree requirements/corecurriculumcomponentarearequirements>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3
Component Area Option	3
Total Credit Hours	42

Gateway Courses

Students pursuing the B.A. degree in Physics must successfully complete each of the following Gateway Courses with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major.

PHY 2103 & PHY 2111	Modern Physics and Modern Physics Laboratory
PHY 2823	Mathematical Physics I
PHY 3203	Classical Mechanics I

Degree Requirements

A. Physics and Astronomy courses

1. Required courses completed with a grade of "C-" or better	
PHY 1943 & PHY 1951	Physics for Scientists and Engineers I and Physics for Scientists and Engineers I Laboratory
	4

PHY 1963 & PHY 1971	Physics for Scientists and Engineers II and Physics for Scientists and Engineers II Laboratory	4
PHY 2103 & PHY 2111	Modern Physics and Modern Physics Laboratory	4
PHY 2823	Mathematical Physics I	3
PHY 3203	Classical Mechanics I	3
PHY 3293	Thermal Physics	3
PHY 3343	Physics Research Laboratory	3
PHY 3423	Electricity and Magnetism	3
2. Select two additional courses from the following:		6
AST 3013	Fundamentals of Astronomy	
AST 3023	Introduction to Astrophysics	
PHY 3143	Introduction to Computational Physics	
PHY 3313	Materials Physics	
PHY 3443	Modern Optics	
PHY 3603	Cosmology	
PHY 4013	Relativity: Special and General	
PHY 4263	Quantum Mechanics I	
PHY 4843	Condensed Matter Theory	

B. Required courses in the College of Sciences

1. Required courses (excluding physics)		
CHE 1103	General Chemistry I	3
CHE 1113	General Chemistry II	3
CHE 1121	General Chemistry I Laboratory	1
CS 1063	Introduction to Computer Programming I	3
or CS 1173	Data Analysis and Visualization	
or CS 2073	Computer Programming with Engineering Applications	
MAT 1214	Calculus I	4
MAT 1224	Calculus II	4
MAT 2214	Calculus III	4
2. Additional approved courses from the College of Sciences.		32
Total Credit Hours		87

Course Sequence Guide for B.A. Degree in Physics

This course sequence guide is designed to assist students in completing their UTSA undergraduate Physics degree requirements. *This is merely a guide and students must satisfy other requirements of this catalog and meet with their academic advisor for individualized degree plans.* Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

B.A. in Physics – Recommended Four-Year Academic Plan

First Year		
Fall		Credit Hours
AIS 1203	Academic Inquiry and Scholarship (core)	3
CHE 1103 or 1143	General Chemistry I	3
CHE 1121	General Chemistry I Laboratory ¹	1

CS 1063, 1173, or 2073	Introduction to Computer Programming I	3
MAT 1214	Calculus I (core and major)	4
WRC 1013	Freshman Composition I (Q) (core)	3
Spring		
CHE 1113 or 1153	General Chemistry II	3
MAT 1224	Calculus II	4
PHY 1943 & PHY 1951	Physics for Scientists and Engineers I (core and major)	4
WRC 1023	Freshman Composition II (Q) (core)	3
College of Sciences elective ²		2
Second Year		
Fall		
MAT 2214	Calculus III	4
PHY 1963 & PHY 1971	Physics for Scientists and Engineers II (core and major)	4
Social & Behavioral Sciences core		3
American History core		3
Spring		
PHY 2103 & PHY 2111	Modern Physics	4
PHY 2823	Mathematical Physics I	3
PHY 3203	Classical Mechanics I	3
American History core		3
Component Area Option core		3
Third Year		
Fall		
PHY 3293	Thermal Physics	3
PHY 3423	Electricity and Magnetism	3
College of Sciences elective ²		3
College of Sciences elective ²		3
Language, Philosophy & Culture core		3
Spring		
PHY 3343	Physics Research Laboratory	3
POL 1133 or 1213	Texas Politics and Society (core)	3
College of Sciences elective ²		3
College of Sciences elective ²		3
Fourth Year		
Fall		
POL 1013	Introduction to American Politics (core)	3
College of Sciences elective ²		3
College of Sciences elective ²		3
College of Sciences elective ²		3
Upper-division AST or PHY elective ³		3
Spring		
College of Sciences elective ²		3
College of Sciences elective ²		3
College of Sciences elective ²		3
Upper-division AST or PHY elective ³		3
Creative Arts core		3
Total Credit Hours:		120.0

- ¹ This laboratory course includes a lecture component as indicated on the University Schedule of Classes.
- ² At least 18 semester credit hours of College of Sciences electives must be at the upper-division level.
- ³ From section A.2. of degree requirements.

Note: Some courses are only offered once a year; Fall or Spring. Check with the Department of Physics and Astronomy for scheduling of courses.

- Minor in Astronomy/Astrophysics (p. 4)
- Minor in Physics (p. 4)

Minor in Astronomy/Astrophysics

The Department of Physics and Astronomy offers a Minor in Astronomy/Astrophysics, which serves to increase the value of the student's major concentration. The minor provides a more comprehensive foundation in physics to those wishing to teach science at the middle and high school levels through applications of important physics concepts. Further, it is a key Science, Technology, Engineering and Mathematics (STEM) subject, due to its critical science, technology, and math components, combined with a popular appeal. All students pursuing the Minor in Astronomy/Astrophysics must complete 20 semester credit hours.

A. Required Courses

AST 3013	Fundamentals of Astronomy	3
AST 3023	Introduction to Astrophysics	3
PHY 1943 & PHY 1951	Physics for Scientists and Engineers I and Physics for Scientists and Engineers I Laboratory	4
PHY 1963 & PHY 1971	Physics for Scientists and Engineers II and Physics for Scientists and Engineers II Laboratory	4

B. Select two of the following courses

AST 3033	Observational Techniques in Astronomy	3
AST 3103	Observational Astronomy Laboratory	3
AST 3303	Introduction to Galactic and Extragalactic Astronomy	3
PHY 3603	Cosmology	3
AST 4203	Stellar Astrophysics	3
AST 4953	Special Studies in Astronomy	3

Total Credit Hours 20

To declare a Minor in Astronomy/Astrophysics, obtain advice, or seek approval of substitutions for course requirements, students should consult their academic advisor.

Minor in Physics

The Department of Physics and Astronomy also offers a Minor in Physics, which serves to increase the value of the student's major concentration. It also provides a more solid foundation in physics to those wishing to teach science at the middle and high school levels. All students pursuing the Minor in Physics must complete 21 semester credit hours.

Required courses:

PHY 1943 & PHY 1951	Physics for Scientists and Engineers I and Physics for Scientists and Engineers I Laboratory	4
---------------------	----------------------------------------------------------------------------------------------	---

PHY 1963 & PHY 1971	Physics for Scientists and Engineers II and Physics for Scientists and Engineers II Laboratory	4
PHY 2103 & PHY 2111	Modern Physics and Modern Physics Laboratory	4
PHY 3203	Classical Mechanics I	3
PHY 3293	Thermal Physics	3
PHY 3423	Electricity and Magnetism	3
Total Credit Hours		21

To declare a Minor in Physics, obtain advice, or seek approval of substitutions for course requirements, students should consult their academic advisor.