



Undergraduate Handbook

2022-2023

CONTACT INFORMATION

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UNDERGRADUATE INFORMATION

Students who love math and want to use it to solve real problems find a home in physics. Students who are interested in science, and discover that they want to know the fundamental principles behind it all, find their way to physics. Students interested in engineering, who want both greater understanding and a more challenging field, change their major to physics. Students seeking a technical degree with broadest possible background discover physics is the place for them.

--University of Utah Physics Alumnus, 2014

PROGRAM DESCRIPTION

Welcome to the Department of Physics and Astronomy! All of the physics degrees and emphases require a calculus-based introductory physics sequence with labs, modern physics, intermediate mechanics, electrodynamics, quantum mechanics, computation, and set of electives. Electives allow students to fine tune their learning and design their program to fit their interests and needs. All degrees and emphases also require calculus I - III, linear algebra and differential equations. Most degrees require partial differential equations and complex variables, or equivalent.

All of the degrees and emphases in physics have similar requirements in the first two years, so it is possible to explore the major before making a final decision on the degree program or emphasis.

ADVISING

We encourage students to make an appointment with their advisor regarding major declaration, course planning, mandatory advising visits, research and internship opportunities, career preparation, or any other concerns. Students should see their academic advisor at least once a year.

TRANSFER STUDENTS

Transfer students are encouraged to contact the advisors early in their academic career, even prior to admission to the University of Utah. Many of the prerequisite requirements for the degree can be completed at transfer institutions.

Credits transferred from USHE and local partner institutions will be articulated automatically. Credits from out-of-state institutions will need to be evaluated for equivalency by the relevant department.

To have physics courses from an out-of-state institution evaluated, please complete the [Transfer Course Evaluation form](#). If you use transfer courses as prerequisites, you will need to request permission codes for each course.

Math courses can be evaluated by submitting the requested information to the [Mathematics Department's transfer evaluation form](#).

STANDARDIZED EXAMS PLACEMENT

If a student has taken an AP or IB Physics exam, they are highly encouraged to meet with their major advisor to discuss appropriate and accurate placement.

Students who have taken a physics or chemistry standardized exam will fulfill the following courses:

Test	Score	Course Fulfilled
AP Physics C: Mechanics	4 or 5	PHYS 2210
AP Physics C: E&M	4 or 5	PHYS 2220
AP Chemistry	4	CHEM 1210
AP Chemistry	5	CHEM 1220

AP Physics 1, AP Physics 2, and IB Physics HL do not count towards the major. Students who took any of the AP Physics exams are encouraged to submit their lab notebook for evaluation.

Students who took the AP Chemistry exam are encouraged to take their lab notebook to the Chemistry Department for evaluation.

Students who have taken a math standardized exam will be placed into the following courses:

Test	Score	Course Placement
AP Calculus AB	3	MATH 1210
AP Calculus AB	4 or 5	MATH 1220
AP Calculus BC	3	MATH 1220
AP Calculus BC	4 or 5	MATH 2210
IB Math SL	5-7	MATH 1060
IB Math HL	4+	MATH 1210

Students with IB HL Math scores should submit their syllabi to the [Mathematics Department's transfer evaluation form](#).

GRADUATION REQUIREMENTS

UNIVERSITY REQUIREMENTS

Minimum University Requirements

Total Credits Requirement	122
Upper Division Hours (3000 Level or Higher at U of U)	40
U of U Residence Hour Requirement	30
(20 of last 30 hours must be earned in residence. Independent Study credits do not count as resident credits.)	
General Education Credits	See Below
Minimum GPA	2.0
Completion of Major Requirements	See Below
Completion of Minor (if desired)	See Dept.

General Education Requirements

- **American Institutions (AI):**
HIST 1700 or ECON 1740 or POLS 1100
- **Writing (WR):** WRTG 2010
- **Quantitative Reasoning (QA/QB):**
Calculus I fills both the QA and QB requirements (or waived by AP credit)
- **Intellectual Explorations (IE):**
 - 2 Fine Arts (FF)
 - 2 Humanities (HF)
 - 2 Social Sciences (BF)

Bachelor Degree Requirements

- **Upper Division Communication/Writing (CW):**
- **Diversity Requirement (DV):**
- **International Requirement (IR):**
- **B.S. or B.A. Requirements:**
Physics major courses fulfill both B.S. QI requirements. The B.A. requirement will be filled with a fourth semester of a upper division language course or credit by special exam.

PHYSICS & ASTRONOMY DEPARTMENT REQUIREMENTS

In addition to the required coursework outlined in this publication, all physics majors are required to:

1. Receive a "C-" or better in all major and minor courses. Teaching majors must receive a "C" or better in all courses required for the teaching endorsement. The Math department requires a "C" or better in all prerequisite courses.
2. Maintain a minimum GPA of 2.0 in major courses. Teaching majors must maintain a minimum GPA of 3.0 to be admitted to the licensure program.
3. Complete at least 12 upper division credit hours of University of Utah Physics and/or Astronomy courses for the major, or 6 for the minor.

REQUIREMENT CHANGES

Students are generally held to the Department of Physics & Astronomy graduation requirements in place at the time they declare their major. Students who interrupt their studies may be held to the graduation requirements in place when they re-enter the University. Graduation requirements shown on this sheet are deemed to be reliable, however, it is the student's responsibility to check with the advisor and general catalog periodically concerning possible changes or corrections.

These requirements are active for the 2022-2023 academic year.

PROGRAM LEARNING OUTCOMES

PROBLEM SOLVING

Physics students:

- (a) can identify the essential physical principles underlying both idealized and real world problems.
- (b) can express problems in the language of mathematics, and
- (c) solve problems alone and in teams using a variety of tools including estimation, simplified models, computational methods, and graphical representations.

SCIENCE METHODS

Physics students:

- (a) can articulate the role of observation and the interplay between experiment and theory in scientific progress.
- (b) can collect and analyze experimental data, and
- (c) estimate and understand the statistical significance and confidence levels of an experimental result.

SCIENCE COMMUNICATION

Physics students can present experimental results and complex physics principles in both written and oral formats with proper citations.

SCIENCE AND SOCIETY

Physics students:

- (a) can apply physics concepts to contemporary systems, and
- (b) recognize the contributions and value of diverse perspectives, backgrounds, and identities within physics and science.

ENHANCE YOUR EXPERIENCE

There are many ways to learn outside of the classroom!

- [Join Society of Physics Students \(SPS\), PASSAGE, or the AstronomUrs Club!](#)
- [Get involved with the Undergrad Student Advisory Council \(USAC\)](#)
- [Meet with a Career Coach](#) to explore career options!
- [Apply for a Research Experience for Undergraduates \(REU\) or internship during the summer!](#)
- [Become a Learning or Teaching Assistant!](#)
- [Apply for departmental, college, and university scholarships!](#)
- [Study abroad through the Learning Abroad program!](#)

Interested in doing research?

Many of our undergraduate students participate in research before they graduate! Research builds critical thinking and problem solving skills, boosts your technical skills, and develops great relationships with mentors and faculty.

- Incoming students are encouraged to apply to the [College of Science Science Research Initiative \(SRI\)](#) and the [ACCESS program](#).
- All physics students are encouraged to apply for Research Experiences for Undergraduates (REU) or internships during the summer.
- Students are also encouraged to reach out to [faculty](#) to discuss available positions and future opportunities within a lab the student is interested in.

AREAS OF RESEARCH

The Department of Physics and Astronomy engages in theoretical and experimental research that spans a broad spectrum of modern physics, strong international reputations of our faculty and programs. The Department of Physics and Astronomy provides research in these areas:

Astronomy

Our astronomy faculty members work on the nature of dark matter, the large scale structure and expansion rate of the Universe, the relation of galaxies to their dark matter halos, the energetics of galaxy clusters, the history of the Milky Way and nearby galaxies, the demographics of massive black holes, the Milky Way's interstellar medium, the astrophysics of compact objects, the sources of the highest energy photons, and the formation of planetary systems.

Astroparticle Physics

The University of Utah is engaged in cutting-edge research in cosmic rays, gamma-rays, and neutrinos. We have a long and distinguished history of leading research into cosmic rays, extremely rare and mysterious visitors from space, detected in the Utah desert. We are part of international collaborations including the Telescope Array Project, VERITAS, HAWC, CTA, and IceCube.

Biophysics

Current biophysics research at the University of Utah is pushing the limits of nanometer-scale optical microscopy technologies, with the goal of studying molecular-scale biological systems; studying the process by which a new enveloped virus is created on the membrane of its host cell; and studying the properties of molecular motors, focusing on how these motors work together, how they are regulated, and how their functioning is disrupted or altered in various diseases.

Condensed Matter Physics

Physicists at the University of Utah are conducting fundamental research on materials that could hail the next advance in electronics: organic semiconductors, non-linear optical solids, high-Tc superconductors, spin electronics, quasicrystals, etc. The University of Utah is recognized as a leader in developing techniques for understanding the properties of these materials, including atomic force microscopy and tunable infrared lasers.

High Energy Physics

Particle physics research at the University of Utah is investigating physics beyond the standard model. Researchers are using connections between theoretical particle physics, cosmology and astrophysics, solving strong interactions of quarks and gluons through numerical simulation, and working on various problems in the frontier of theoretical physics including particle theory, condensed matter theory, and mathematical physics.

Physics Education Research

Physics Education Research (PER) is an inherently interdisciplinary endeavor that studies how people learn the content and culture of physics. Investigations in PER are diverse and include looking at student learning in the classroom all the way up to the policies that govern the physics community and affect physicist's careers. Students of PER move on to many interesting careers, including academia, high school teaching, consulting, university administration, entrepreneurship, and more.

The Physics Bachelor's Degree is designed to give students a flexible path and a firm foundation toward work in industry. The core includes mechanics, electricity and magnetism, modern physics, special relativity, and quantum mechanics. Students gain practical experience in laboratory techniques, writing, and computer programming. Math methods and preparation in physics are strong components of this program, designed to help students gain confidence in mathematical application. The flexible advanced electives allow students to fine-tune their path in order to explore career options.

Core Physics Courses – Required for All Majors

PHYS 1980	Undergrad Seminar I	1
PHYS 3980	Undergrad Seminar II	1
PHYS 2210	Physics I for Sci & Eng	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220	Physics II for Sci & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1
PHYS 2235	Computational Lab for Phys	1
PHYS 2710	Physics III: Modern Physics	4
PHYS 3010	Physics IV: Intermediate Mech	4
PHYS 4010	Physics V: EM & QM	4

Core Math Courses for this Emphasis

MATH 1050	College Algebra (if needed)	4
MATH 1060	Trigonometry (if needed)	3
MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250 ¹	Differential Equations and Linear Algebra	4

¹Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

Advanced Physics Electives

Choose three electives:

PHYS/ASTR	3000 Level or higher	
PHYS/ASTR	4000 Level or higher	
PHYS/ASTR	4000 Level or higher	

Practical Physics Electives

One of three electives must be selected from the list below:

PHYS 3330	Digital Audio & Video	3
PHYS 3410	Modern Optics	4
PHYS 3610	Electronics for Sci Instrumentation	3
PHYS 3620	Data Acquisition for Sci Instrumentation	3
PHYS 3719/3729	Advanced Undergraduate Lab	4
PHYS 3730	Computational Physics I	4
PHYS/ASTR 4060	Observational Astronomy	3
PHYS 4800	Undergraduate Research	3
PHYS 4999	Senior Honors Thesis	3
PHYS 5140	Research and Teaching in Physics Education	3

PHYSICS MAJOR COMPREHENSIVE EMPHASIS

B.S./B.A.

The Physics Bachelor's Degree with a Comprehensive Physics emphasis is intended for students who are planning to pursue graduate work in physics. The Comprehensive Physics emphasis allows for deeper and broader preparation in computational physics, thermodynamics, and quantum mechanics. Students choose advanced and practical electives to best meet their goals and interests.

Core Physics Courses – Required for All Majors

PHYS 1980	Undergrad Seminar I	1
PHYS 3980	Undergrad Seminar II	1
PHYS 2210	Physics I for Sci & Eng	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220	Physics II for Scientists & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1
PHYS 2235	Computational Lab	1
PHYS 2710	Physics III: Modern Physics	4
PHYS 3010	Physics IV: Intermediate Mech	4
PHYS 4010	Physics V: EM & QM	4

Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250 ¹	Differential Equations and Linear Algebra	4
MATH 3150/5440	Partial Differential Equations for Eng/Partial Differential Equations	2/4
MATH 3160/4200	Applied Complex Variables/Complex Variables	2/3

¹Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses

PHYS 4730	Computational Physics I	3
PHYS 3760	Thermo & Stat Mechanics	3
PHYS 5450	Adv Quantum Mechanics	4

Advanced Physics Electives

Select one course from PHYS 4000 or above.

PHYS 4000+		
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Practical Physics Electives

Select two courses from the list below:

PHYS 3330	Digital Audio and Video	3
PHYS 3410	Found of Modern Optics	4
PHYS 3610	Electronics for Sci Instrumentation	3
PHYS 3620	Data Acquisition for Sci Instrumentation	3
PHYS 3719/3729	Adv. Undergraduate Lab	4
ASTR 4060	Observational Astronomy	3
PHYS 4800 OR PHYS 4999	Undergraduate Research OR Senior Honors Thesis	3
PHYS 5140	Research and Teaching in Physics Education	4

PHYSICS MAJOR APPLIED PHYSICS EMPHASIS

B.S./B.A.

The Physics Bachelor's Degree with an Applied Physics emphasis is intended for students who are planning on pursuing careers in experimental physics, engineering or earth science, law school, or other related fields. The Applied Physics emphasis allows students more options for additional practical courses. Students choose advanced and practical electives to best meet their goals and interests.

Core Physics Courses – Required for All Majors

PHYS 1980	Undergrad Seminar I	1
PHYS 3980	Undergrad Seminar II	1
PHYS 2210	Physics I for Sci & Eng	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220	Physics II for Scientists & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1
PHYS 2235	Computational Lab	1
PHYS 2710	Physics III: Modern Physics	4
PHYS 3010	Physics IV: Intermediate Mech	4
PHYS 4010	Physics V: EM & QM	4

Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250 ¹	Differential Equations and Linear Algebra	4
MATH 3150/5440	Partial Differential Equations for Eng/Partial Differential Equations	2/4
MATH 3160/4200	Applied Complex Variables/Complex Variables	2/3

¹Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses

PHYS 3760	Thermo & Stat Mechanics	3
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Advanced Physics Electives

Select one course from PHYS 4000 or above:

PHYS 4000+		
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Practical Physics Electives

Select three courses from the list below:

PHYS 3330	Digital Audio and Video	3
PHYS 3410	Found of Modern Optics	4
PHYS 3610	Electronics for Sci Instrumentation	3
PHYS 3620	Data Acquisition for Sci Instrumentation	3
PHYS 3719/3279	Undergraduate Lab/Honors Undergraduate Lab	4
PHYS 3730	Computational Physics I	4
ASTR 4060	Observational Astronomy	3
PHYS 4800 OR PHYS 4999	Undergraduate Research OR Senior Honors Thesis	3
PHYS 5140	Research and Teaching in Physics Education	4

PHYSICS MAJOR

ASTRONOMY & ASTROPHYSICS EMPHASIS

B.S./B.A.

The Physics Bachelor's Degree with an Astronomy & Astrophysics Emphasis prepares students for careers in astronomy or astrophysics. Students choose topical and practical electives to prepare them for a wide range of careers. Because it is a strong physics degree, students with this degree also pursue careers in other areas of physics or related fields.

Core Physics Courses – Required for All Majors

PHYS 1980	Undergrad Seminar I	1
PHYS 3980	Undergrad Seminar II	1
PHYS 2210	Physics I for Sci & Eng	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220	Physics II for Scientists & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1
PHYS 2235	Comp Lab for Physicists	1
PHYS 2710	Physics III: Modern Physics	4
PHYS 3010	Physics IV: Intermediate Mech	4
PHYS 4010	Physics V: EM & QM	4

Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250 ¹	Differential Equations and Linear Algebra	4
MATH 3150/5440	Partial Differential Equations for Eng/Partial Differential Equations	2/4
MATH 3160/4200	Applied Complex Variables/Complex Variables	2/3

¹Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses

ASTR 3070	Foundations of Astronomy	3
PHYS 3760 OR PHYS 5450	Thermo & Stat Mechanics OR Intro to Quantum Mechanics	3 4

Topical Astronomy Electives

Select two courses from the list below:

ASTR 4070	Extragalactic Astrophysics	3
ASTR 4080	Intro to Cosmology	3
ASTR 4090	Stellar Astrophysics	3
ASTR 5560	Stars and Stellar Populations	3
ASTR 5570	Galaxies	3
ASTR 5580	Cosmology	3
ASTR 5590	High Energy Astrophysics	3

Practical Electives

Select two courses from the list below:

PHYS 3410	Found of Modern Optics	3
PHYS 3610	Electronics for Sci Instrument	3
PHYS 3620	Data Acquisition for Sci Instrumentation	3
PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
PHYS 3730	Computational Physics I	4
ASTR 4060	Observational Astronomy	3
PHYS 4800 OR PHYS 4999	Undergraduate Research OR Senior Honors Thesis	3
CMP 3850 OR 3851	Dark Sky Studies: Lightscapes or Nightscapes	3

Advanced Physics Electives

Select one PHYS/ASTR 4*** or 5*** course:

PHYS/ASTR 4***/5***		
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PHYSICS MAJOR

BIOMEDICAL PHYSICS EMPHASIS

B.S./B.A.

The Physics Bachelor's Degree with a Biomedical Physics emphasis is designed with the intent of preparing students to complete their premed requirements as well as earn a degree in physics. This is an ideal degree for applying to medical or other professional schools. Students also use this degree program to pursue biophysics or medical physics. Students choose electives in biology, chemistry, and physics to best meet their goals and interests.

Core Physics Courses – Required for All Majors

PHYS 1980	Undergrad Seminar I	1
PHYS 3980	Undergrad Seminar II	1
PHYS 2210	Physics I for Sci & Eng	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220	Physics II for Scientists & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1
PHYS 2235	Comp Lab fo Physicists	1
PHYS 2710	Physics III: Modern Physics	4
PHYS 3010	Physics IV: Intermediate Mech	4
PHYS 4010	Physics V: EM & QM	4

Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250 ¹	Diff Eq and Lin Alg	4
MATH 4600	Mathematics in Physiology and Medicine ²	4

¹Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

²Students may substitute MATH 3150-3160 for MATH 4600.

Chemistry Courses for this Emphasis

CHEM 1210/1211	General Chemistry I/Honors General Chemistry I	4
CHEM 1215/1240	Gen ChemLab I/Honors Gen Chem Lab I	1
CHEM 1220/1221	General Chemistry II/Honors General Chemistry II	4
CHEM 1225/1241	Gen ChemLab II/Honors Gen Chem Lab II	1
CHEM 2310/2311	Organic Chem I/Honors Organic Chem I	4
CHEM 2315	Organic Chem Lab I	2

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses

PHYS 3760	Thermo & Stat Mechanics	3
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Additional Physics Electives

Select one course from the advanced physics electives and two courses from the practical physics electives:

Advanced		
Practical		
Practical		

Advanced Physics Electives:

PHYS 4210: Optics in Bio, PHYS 4230: Molecular Motors, PHYS 4310: Physics in Bio, PHYS 5110: Nuclear/Particle Phys, PHYS 5510: Solid State Phys I

Practical Physics Electives:

PHYS 3330: Audio and Video, PHYS 3410: Modern Optics, PHYS 3610: Electronics, PHYS 3620: Data Acquisition, PHYS 3719/3729: Undergraduate Lab/Honors Undergraduate Lab, PHYS 3730: Computational Physics I, PHYS 4800: Undergraduate Research, PHYS 4999: Senior Honors Thesis

Allied Courses

Select five credit hours from chemistry and four courses from biology:

1.	CHEM		
2.	CHEM		
1.	BIOL		
2.	BIOL		
3.	BIOL		
4.	BIOL		

Chemistry Electives: CHEM 2320, CHEM 2321, CHEM 2325, CHEM 3000, CHEM 3100, CHEM 3130, CHEM 3200, CHEM 5810

Biology Electives: BIOL 1610, BIOL 2020, BIOL 2021, BIOL 2030, BIOL 2325, BIOL 2420, BIOL 3410, BIOL 3460, BIOL 3470, BIOL 3510, BIOL 3515, BIOL 3550, BIOL 5495

PHYSICS MAJOR

B.S./B.A.

COMPUTATIONAL PHYSICS & ASTRONOMY EMPHASIS

The Physics Bachelor's Degree with a Computational Physics and Astronomy Emphasis is designed for students interested in focusing on computational methods in physics and astronomy. Students gain skills in a wide variety of programming languages and methods, as well as applications to physical systems. Students choose electives in computer science, data science, math, physics, and astronomy to best meet their goals and interests.

Core Physics Courses – Required for All Majors

PHYS 1980	Undergrad Seminar I	1
PHYS 3980	Undergrad Seminar II	1
PHYS 2210	Physics I for Sci & Eng	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220	Physics II for Scientists & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1
PHYS 2235	Comp Lab for Physicists	1
PHYS 2710	Physics III: Modern Physics	4
PHYS 3010	Physics IV: Intermediate Mech	4
PHYS 4010	Physics V: EM & QM	4

Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250 ¹	Differential Equations and Linear Algebra	4
MATH 3150/5440	Partial Differential Equations for Eng/Partial Differential Equations	2/4
MATH 3160/4200	Applied Complex Variables/Complex Variables	2/3

Computer Science Courses for this Emphasis

Complete one set of courses from the list below²:

CS 1400 + CS 1410 + CS 2420
CS 1420 + CS 2420 + One Additional Computational Elective

¹Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250

²Placement into your computer science track will depend on your previous experience.

³ASTR 3070 is a required prerequisite for other astronomy courses.

Advanced Physics Courses

PHYS 3730	Computational Physics I	3
PHYS 3760	Thermo & Stat Mechanics	3
PHYS 5730	Computational Physics II	4

Computational Electives

Select one course from the list below:

CS 3200	Intro to Scientific Computing and Data Computing	3
CS 3500	Software Practice	4
CS 3190	Foundations of Data Analysis	3
CS 4230	Parallel Programming	3
CS 5635	Visualization for Scientific Data	3
DS 2500	Data Wrangling	3
MATH 5600/5610	Survey of Numerical Analysis	4
MATH 5740	Mathematical Modeling	3

Physics and Astronomy Electives

Select two courses in any combination from the list below or the computational electives list above :

PHYS 5110	Intro to Nuclear and Particle Physics	3
PHYS 5210	Intro to Gravitation	3
PHYS 5450	Intro to Quantum Mechanics	4
PHYS 5460	Quantum Mechanics and Statistical Mechanics	4
PHYS 5510	Solid State Physics I	3
PHYS 5520	Solid State Physics II	3
PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
ASTR 3070 ³	Foundations of Astronomy	3
ASTR 4060	Observational Astronomy	3
ASTR 4070	Extragalactic Astrophysics	3
ASTR 4080	Intro to Cosmology	3
ASTR 4090	Stellar Astrophysics	3

The Physics Teaching Bachelor's Degree is intended for students who plan on becoming teachers in the K-12 school system. It includes all the required courses for an endorsement in Physics and Physical Science through the Utah State Office of Education. This major does have an optional combined BS/MEd degree that allows students to complete both degrees and licensure in 5 years. Students in the teaching degree program should also meet with the Urban Institute for Teacher Education (UITE) advisor Sara Hatch, sara.hatch@utah.edu.

Core Physics Courses – Required for This Major

	PHYS 1980	Undergrad Seminar I	1
	PHYS 3980	Undergrad Seminar II	1
	PHYS 2210	Physics I for Sci & Eng	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2220	Physics II for Sci & Eng	4
	PHYS 2225	Physics II Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2710	Physics III: Modern Physics	4
	PHYS 3010	Physics IV: Intermediate Mech	4
	PHYS 4010	Physics V: EM & QM	4

Core Math Courses for this Major

	MATH 1050	College Algebra	4
	MATH 1060	Trigonometry	3
	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210	Calculus III	3
	MATH 2250	Differential Equations and Linear Algebra	4

Chemistry Courses for this Major

	CHEM 1210/1211	General Chemistry I/Honors General Chemistry I	4
	CHEM 1215/1240	Gen ChemLab I/Honors Gen Chem Lab I	1
	CHEM 1220/1221	General Chemistry II/Honors General Chemistry II	4

Advanced Physics Courses

	PHYS 5140	Physics Education Research	3
	ASTR 3070	Foundations of Astronomy	3
	PHYS or ASTR	Any elective 3000-level or higher (except PHYS 3111 or 3670)	3

Allied Elective Courses

Select one course

	ATMOS 1010	Severe and Unusual Weather	3
	ATMOS 1020	Climate Change	3
	ATMOS 5400	The Climate System	3

Education Courses

	EDU 1010 or SCI 3670 or SCI 5050	Intro to Teaching or Science Communication and Mentoring or Science of Learning	3
	ETHNC 25**	Ethnic Studies Elective (2550,2570,2580,2590)	3
	ECS 2150 OR SCI 3900	Intro to Multi Cultural Ed or Being Human in STEM	3
	ED PS 3721	Adolescent Psychology	3
	EDU 5170	Secondary Science Methods	3
	ECS 5709	Building Family Partnership	3

PHYSICS MINOR

Intro Physics Courses

Select up to ten credit hours from the list below:

	PHYS 2210	Physics I for Scientists & Engineers	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2220	Physics II for Scientists & Eng	4
	PHYS 2225	Physics II Lab for Sci & Eng	1

Upper Division Courses for This Minor*

Select six or more credit hours of upper division approved coursework, totalling 16 credit hours:

1.	PHYS/ASTR		
2.	PHYS/ASTR		
3.	PHYS/ASTR		

*NOTE: To fulfill requirement, student must take any Physics or Astronomy course numbered 3000-5999, EXCEPT:

PHYS 3111, PHYS 3210, PHYS 3220, PHYS 3670, PHYS 3949, PHYS 3970, PHYS 4800, PHYS 4999

ASTRONOMY MINOR

Required Prerequisite Courses

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210	Calculus III	3
	PHYS 2210	Physics I for Scientists & Engineers	4
	PHYS 2220	Physics II for Scientists & Eng	4
	ASTR 3070	Foundations of Astronomy	3

Elective Courses for This Minor

Select three courses from the list below:

	ASTR 4060	Observational Astronomy	3
	ASTR 4070	Extragalactic Astrophysics	3
	ASTR 4080	Intro to Cosmology	3
	ASTR 4090	Stellar Astrophysics	3
	ASTR 5560	Stars and Stellar Populations	3
	ASTR 5570	Galaxies	3
	ASTR 5580	Cosmology	3

HONORS DEGREE IN PHYSICS

Honors College Requirements

2 Intellectual Traditions Courses	6
1 Honors Writing Course	3
1 Honors Science Course	3-4
Honors Electives	9
Honors Thesis (PHYS/ASTR 4999)	3

Department Requirements

In addition to the requirements for the physics degree, students seeking an Honors Degree must also meet the following requirements:

B or better in all courses required for major	
PHYS and ASTR GPA of at least 3.5	
Overall GPA of at least 3.5	
Complete 9 credit hours of approved honors course work.	

Honors Science/Elective Courses

Courses offered by the Department of Physics & Astronomy that fill Honors elective requirements are:

PHYS 3729	Honors Undergraduate Lab	4
PHYS 4410	Classical Physics I (through Fall 2022)	4
PHYS 4420	Classical Physics II (through Spring 2023)	4
PHYS 4800	Undergraduate Research	3
PHYS 5450	Intro to Quantum Mechanics	4
PHYS 5460	Quantum Mechanics and Statistical Mechanics	4
PHYS 5510	Solid State Physics I	3
PHYS 5520	Solid State Physics II	3
ASTR/PHYS 5560	Stars and Stellar Populations	3
ASTR/PHYS 5570	Galaxies	3

PHYSICS TEACHING MINOR

Intro Physics Courses

PHYS 2210	Physics I for Scientists & Engineers	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220	Physics II for Scientists & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1

Core Math Courses for This Minor

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250 ¹	Differential Equations and Linear Algebra	4

¹Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

Required Courses for This Minor

PHYS 3740	Intro to Quantum Theory and Relativity	3
EDU 5170	Secondary Science Methods	3

Elective Course for This Minor*

Select at least one course of upper division approved coursework:

1.		
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*NOTE: To fulfill requirement, student must take any Physics or Astronomy course numbered 3000-5999, EXCEPT:

PHYS 3111, PHYS 3210, PHYS 3220, PHYS 3670, PHYS 3949, PHYS 3970, PHYS 4800, PHYS 4999

WHAT CAN I DO WITH MY MAJOR?

Physics students are first and foremost problem solvers, with strong critical thinking skills and creativity. Physics opens doors to several different types of careers in science, engineering, and technology. University of Utah alumni and graduates nationwide go on to fulfilling careers in a variety of fields.

Primary Fields

- Academia
- Laboratories, Observatories, Institutions, and Research
- Medicine & Healthcare
- Military & Defense
- Tech Industry
- Design & Development
- Manufacturing & Mechanics
- Gaming
- Power, Energy, and Environment
- Law
- Banking & Financial Services
- Education and Communication
- Other

Alumni - Where Are They Now?

- <https://careers.utah.edu/where-are-they-now/>

National Statistics for Physics Bachelor's

- <https://www.aip.org/statistics/employment/bachelors>

Society of Physics Students Career Toolbox

- <https://www.spsnational.org/sites/all/career-toolbox/>

Common Job Titles with B.S./B.A in Physics

Engineering

- Systems Engineer
- Mechanical Engineer
- Manufacturing Technician
- Field Engineer
- Technical Services Engineer
- Design Engineer

Tech, Computer Hardware & Software

- Software Engineer
- Programmer
- Web Developer
- IT Consultant
- Systems Analyst
- Technical Support Staff
- Analyst

Research & Technical

- Research Assistant
- Research Associate
- Research Technician
- Lab Technician
- Lab Assistant
- Accelerator Operator
- Physical Sciences Technician

Education

- High School Physics Teacher
- High School Science Teacher
- Middle School Science Teacher

CAREER OPPORTUNITIES WITHIN EMPHASES

Comprehensive Emphasis

- Interdisciplinary Fields involving physics, mathematics and computation
- Scientific Writing & Journalism

Applied Emphasis

- Chemical and Environmental Industries
- Energy
- Law
- Medical Physics
- Physics Research (in academic, national or industrial laboratories)
- Teaching and Education
- Technical Industry & Government

Astronomy & Astrophysics Emphasis

- Aerospace
- Defense Systems
- Government Research
- Observatories
- Planetariums/Museums
- Teaching

Biomedical Physics Emphasis

- Academic & Clinical Research
- Biomedical Engineering
- Government Agencies
- Medical & Dental School
- Medical Instrumentation and Devices
- Military
- Pharmaceutical Industry
- Scientific Computation

Computational Emphasis

- Computer and Electronics Engineering
- Software Engineer
- Programmer
- Web Developer
- IT Consultant
- Systems Analyst
- Technical Support Staff
- Materials Design

Physics Teaching Emphasis

- Secondary School Physics Teacher
- Secondary School Science Teacher

For more information about career opportunities and current alumni positions visit <https://careers.utah.edu/>

STUDENT GROUPS

Student clubs and organizations are a great way to make friends, build connections on campus, and gain leadership skills outside of the classroom. Working as a teaching or learning assistant builds your academic and learning skills, and develops great relationships with your professors and fellow students. Check out the many opportunities to get involved within our department and across campus.

Society of Physics Students (SPS)

The Society of Physics Students is a student-led organization whose mission is to bring together all students who are interested in physics. SPS exists to help students transform themselves into contributing members of the professional community. SPS supports initiatives that impact their community through its members, advisers, chapters, and leadership. Through scholarships, awards and grants, career and professional development, research opportunities, and educational outreach, SPS also supports students, advisers, and departments.

For more information visit <https://getinvolved.utah.edu/organization/sps-university-of-utah-chapter>.

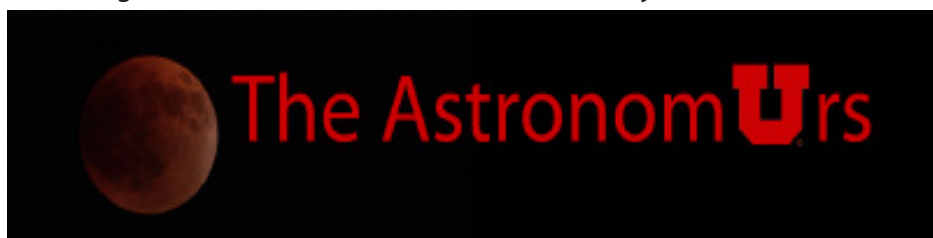


PASSAGE

The mission of the Physics and Astronomy Society for the Support and Advocacy for Gender Equity (PASSAGE) is to actively promote an inclusive environment for those of all gender identities within the department. We frequently host social and career development events to build a supportive community among our members. We also work on advocacy and outreach to increase equity and sense of belonging in the sciences.

Undergraduate Student Advisor Committee (USAC)

Our Undergraduate Student Advisory Committee (USAC) advises the Department of Physics & Astronomy in matters concerning their undergraduate students. We do this primarily through our participation in the RPT process for the Department of Physics and Astronomy. In addition, we occasionally participate in other activities promoting student involvement within the Department. Overall, USAC is an amazing way to be a voice for your fellow Undergraduate students in matters concerning the Department of Physics and Astronomy. If you are interested, please email physicsusac@gmail.com for more information on how to join!



AstronomUrs

The AstronomUrs is an outreach group, run from the South Physics Observatory at the University of Utah, which conducts extensive outreach activities of wide and far-reaching scope, from physics demonstrations, star parties, K-12 presentations, astronomy festivals, and much more. We also host weekly star parties at the observatory, open to the public. Our audience is broad, including, but not limited to, K-12 schools, state and national parks, community groups, amateur astronomers, university organizations, and dark-sky advocacy groups. For more information, visit (<https://observatory.astro.utah.edu/>)

For more information or other student groups, visit our Student Involvement & Employment page at: <https://www.physics.utah.edu/undergraduate-program/student-involvement-employment/>

SCHOLARSHIP INFORMATION

The Department of Physics & Astronomy welcomes applications from all declared undergraduate student majors in physics for all of our scholarships! Transfer and incoming first year students are also welcome to apply.

How to Apply

All applications will be submitted through the Academic Works scholarship system through the University of Utah Scholarship Office. Complete both the University General Application and the Department of Physics & Astronomy General Application. You will automatically be reviewed for all scholarships for which you qualify.

Department applications generally require the following, unless otherwise specified:

- A one-two page personal statement from the applicant describing their accomplishments, need for the scholarship, and future goals.
- Current transcripts.
- Two letters of support from a faculty instructor or research advisor. Preference will be accorded to students with outstanding academic performance.
- Although not required, it is highly encouraged you complete a Free Application for Federal Student Aid (FAFSA) so you don't miss out on other aid opportunities.

Please submit all application materials through the online application system by February 15th. Students who have applied for scholarships will be reviewed by the scholarship committee in March. Students will be notified via U-mail if they are to be awarded a scholarship after the committee has made their final decision.

SUPPORT RESOURCES

We know that physics is tough...but so are you! We want our students to succeed, so there are several resources to get additional help outside of the classroom. Most of the following resources are FREE to students, so use them!

- **Physics Help Lab**- We have teaching assistants in a majority of introductory courses that host office hours in JFB 219. Students can attend during any time block, regardless of the course they are enrolled in. Work on homework, ask questions, and get free help!
- **Math Tutoring Center**- The Department of Math offers free tutoring for Math 990 and math classes at the 1000 and 2000 level, as well as Math 3070-3080, 3140, 3150, 3160. [Find updated hours here.](#)
- **Learning Center**- The Learning Center offers free tutoring for a variety of subjects across campus, including physics. Appointments are one-on-one with a tutor, in-person or virtually. To learn more, [visit their website here.](#)
- **University Writing Center**- The Writing Center is a FREE service to students at the University of Utah. We want to help you develop strategies to make you a better writer and help you to see your potential as an academic author. The Marriott Library Writing Center is located on the 2nd floor in room 2701. [Find current hours and other information on the University Writing Center's website.](#)
- **University Counseling Center**- The University Counseling Center provides students, staff, and faculty with individual and group counseling, workshops, and classes. For the scope of their services, [check their website here.](#)
- **Student Success Advocates**- Student Success Advocates support you in creating your success here at the University of Utah. They know that your situation is unique, so they take time to work closely with you to learn about your particular needs, aspirations, and goals. [Meet your Student Success Advocate here!](#)
- **Basic Need Collective**- The Basic Needs Collective provides basic life resources, including non-perishable, nourishing food, for our students, their families, faculty, and staff. You can access the Basic Needs Collective and Feed U Pantry in the basement of the Union with your student ID card. [Check out their website here.](#)