



# Undergraduate Handbook

## CONTACT INFORMATION

Cyri Dixon  
Academic Advisor  
cyri.dixon@utah.edu  
801-587-0650  
physics.utah.edu/advising

Professor Anil Seth, Ph.D.  
Director of Undergraduate Studies  
aseth@astro.utah.edu

# 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

A degree in physics is a 4-year degree starting with calculus. All of the physics degrees and emphases require a calculus-based introductory physics sequence with labs, a course in modern physics, thermodynamics, statistical mechanics, a practical physics course, and an advanced physics course. Most degrees and emphases also require a course in classical mechanics, advanced electrodynamics, and quantum mechanics. The degrees differ in the number of semesters of each of these courses, the number and type of required practical courses, and the requirements for the depth and breadth courses. 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, involvement opportunities, including research, prepare for post-graduation, 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](#).

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	MATH 1220 or 1250
AP Calculus AB	5	MATH 1250 or 1220
AP Calculus BC	3	MATH 1220
AP Calculus BC	4 or 5	MATH 1260 or 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 an 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.
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 periodically concerning possible changes or corrections.

# 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 \(SPS\), Women in Physics and Astronomy \(UWomPA\), 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 \(REU\) 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) 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.

The Physics Bachelor's Degree is designed to give students the deepest and broadest understanding of physics to lay a firm foundation for graduate work in physics or related discipline. The classical physics and quantum mechanics courses provide advanced and in-depth instruction in topics that are the most important for success in physics graduate studies. This degree also provides practical experience in laboratory techniques, writing, and computer programming.

## Core Physics Courses – Required for All Majors

PHYS 1970	Undergrad Seminar I	1
PHYS 1980	Undergrad Seminar II	1
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
PHYS 2235	Comp Lab for Physicists	1
PHYS 3740	Intro to Quantum Theory and Relativity	3
PHYS 3760	Thermodynamics and Statistical Mechanics	3

## Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210 <sup>1</sup>	Calculus III	3
MATH 2250 <sup>2</sup>	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

<sup>1</sup>Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.

<sup>2</sup>Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

## Advanced Physics Courses

PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
PHYS 3730	Computational Physics I	4
PHYS 4410	Classical Physics I	4
PHYS 4420	Classical Physics II	4
PHYS 5450	Intro to Quantum Mechanics	4

## Advanced Physics Electives

Select two courses from the list below:

PHYS 5110	Intro to Nuclear and Particle Physics	3
PHYS 5210	Intro to Gravitation	3
PHYS 5460	Quantum Mechanics and Statistical Mechanics	4
PHYS 5510	Solid State Physics I	3
PHYS 5520	Solid State Physics II	3
PHYS 5730	Computational Physics II	4

## 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

# 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 doing graduate research in experimental physics, who are interested in graduate school in related areas such as engineering or earth science, who are thinking about law school, or who plan on going directly into industry after graduating with their Bachelor's. 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 1970	Undergrad Seminar I	1
PHYS 1980	Undergrad Seminar II	1
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
PHYS 2235	Computational Lab	1
PHYS 3740	Intro to Quantum Theory and Relativity	3
PHYS 3760	Thermodynamics and Statistical Mechanics	3

## Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210 <sup>1</sup>	Calculus III	3
MATH 2250 <sup>2</sup>	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

## 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

## Advanced Physics Courses

PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
PHYS 3730	Computational Physics I	4
PHYS 5010	Classical Mechanics and Quantum Mechanics	4
PHYS 5020	Electricity and Magnetism and Quantum Mechanics	

## Advanced Physics Electives

Select one course from the list below:

PHYS 5110	Intro to Nuclear and Particle Physics	3
PHYS 5210	Intro to Gravitation	3
PHYS 5510	Solid State Physics I	3
PHYS 5730	Computational Physics II	4

## 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
ASTR 4060	Observational Astronomy	3
PHYS 5760	Princ of Physical Measurement and Instrumentation	3
PHYS 4800 OR PHYS 4999	Undergraduate Research OR Senior Honors Thesis	3

<sup>1</sup>Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.

<sup>2</sup>Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

# PHYSICS MAJOR

## ASTRONOMY & ASTROPHYSICS EMPHASIS

B.S./B.A.

The Physics Bachelor's Degree with an Astronomy & Astrophysics Emphasis prepares students for graduate school in Astronomy or Astrophysics. At its core, it is the same sequence of courses that are in the Physics Bachelor's Degree, but the depth and breadth courses have been replaced with astronomy electives, allowing students to study astronomy as an undergraduate. Because it is a strong physics degree, students with this degree also attend graduate school in other areas of physics, or related fields.

### Core Physics Courses – Required for All Majors

PHYS 1970	Undergrad Seminar I	1
PHYS 1980	Undergrad Seminar II	1
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
PHYS 2235	Comp Lab for Physicists	1
PHYS 3740	Intro to Quantum Theory and Relativity	3
PHYS 3760	Thermodynamics and Statistical Mechanics	3

### Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210 <sup>1</sup>	Calculus III	3
MATH 2250 <sup>2</sup>	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

<sup>1</sup>Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.

<sup>2</sup>Qualified 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 4410	Classical Physics I	4
PHYS 4420	Classical Physics II	4
PHYS 5450	Intro to Quantum Mechanics	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
CMP 3850 OR 3851	Dark Sky Studies: Lightscapes or Nightscapes	3

### Practical Physics 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

### Advanced Physics Electives

Select one PHYS/ASTR 5\*\*\* course:

PHYS/ASTR 5***		
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# PHYSICS MAJOR

## BIOMEDICAL PHYSICS EMPHASIS

B.S./B.A.

The Physics Bachelor's Degree with a Biomedical Physics emphasis was designed by a professor in the department who holds both a PhD in Physics and an MD. The degree is designed with the intent of allowing students to complete their premed requirements as well as complete a degree in physics. This is an ideal degree for applying to medical school. Students also use this degree program to prepare to study biophysics or medical physics. Students choose electives to best meet their goals and interests.

### Core Physics Courses – Required for All Majors

PHYS 1970	Undergrad Seminar I	1
PHYS 1980	Undergrad Seminar II	1
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
PHYS 2235	Comp Lab for Physicists	1
PHYS 3740	Intro to Quantum Theory and Relativity	3
PHYS 3760	Thermodynamics and Statistical Mechanics	3

### Core Math Courses for this Emphasis

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

<sup>1</sup>Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.

<sup>2</sup>Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

<sup>3</sup>Students 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 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
PHYS 5010	Classical Mechanics and Quantum Mechanics	4
PHYS 5020	Electricity and Magnetism and Quantum Mechanics	4

### Additional Physics Electives

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

Advanced		
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 3730: Computational Physics I, PHYS 5739: Scanning Electron Microscopy, PHYS 5760: Physical Measure and Instrument, 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 4800, CHEM 4801, CHEM 5810

Biology Electives: BIOL 1610, BIOL 2020, BIOL 2021, BIOL 2030, BIOL 2210, BIOL 2325, BIOL 2420, BIOL 3510, BIOL 3515, BIOL 3550, BIOL 4955, BIOL 4995

# PHYSICS MAJOR COMPUTATIONAL EMPHASIS

B.S./B.A.

The Physics Bachelor's Degree with a Computational Emphasis is designed for students interested in focusing on computational methods in physics and astronomy. A broad range of electives allows students to customize their experience toward their interests.

## Core Physics Courses – Required for All Majors

PHYS 1970	Undergrad Seminar I	1
PHYS 1980	Undergrad Seminar II	1
PHYS 2210	Physics I for Scientists & Engineers	4
PHYS 2215	Physics I Lab for Sci & Eng	1
PHYS 2220/3220	Physics II for Scientists & Eng	4
PHYS 2225	Physics II Lab for Sci & Eng	1
PHYS 2235	Comp Lab for Physicists	1
PHYS 3740	Intro to Quantum Theory and Relativity	3
PHYS 3760	Thermodynamics and Statistical Mechanics	3

## Core Math Courses for this Emphasis

MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210 <sup>1</sup>	Calculus III	3
MATH 2250 <sup>2</sup>	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 below<sup>3</sup>:

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

<sup>1</sup>Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.

<sup>2</sup>Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

<sup>3</sup>Placement into your computer science track will depend on your previous experience.

<sup>4</sup>ASTR 3070 is a required prerequisite for other astronomy courses.

## Advanced Physics Courses

PHYS 3730	Computational Physics I	4
PHYS 4410	Classical Physics I	4
PHYS 4420	Classical Physics II	4
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	Undergraduate Lab	4
ASTR 3070 <sup>4</sup>	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 secondary school system. It includes all the required courses for an endorsement in Physics and Physics 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 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 1970	Undergrad Seminar I	1
PHYS 1980	Undergrad Seminar II	1
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
PHYS 2235	Comp Lab for Physicists	1
PHYS 3740	Intro to Quantum Theory and Relativity	3
PHYS 3760 OR CHEM3070	Thermodynamics and Statistical Mechanics OR Thermodynamics and Chemical Kinematics	3 or 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 4410	Classical Physics I	4
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	4
PHYS 4420	Classical Physics II	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
ASTR/PHYS 5580	Cosmology	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 <sup>1</sup>	Calculus III	3
MATH 2250 <sup>2</sup>	Differential Equations and Linear Algebra	4

<sup>1</sup>Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.

<sup>2</sup>Qualified 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