

## **Summary of Degree Requirements for Students Entering in Catalog Year Fall 2016 or later: [Department of Physics & Astronomy](#)**

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### **Degrees Offered**

The department of Physics and Astronomy offers courses of study leading to (1) a Bachelor of Arts degree in Astronomy, (2) a Bachelor of Arts degree in Physics and (3) a Bachelor of Science degree in Physics. There is also an Astrophysics concentration for the Bachelor of Science in Physics.

### **Advanced Placement**

Students with a score of 3, 4 or 5 on the Physics B test will receive credit for PHYS 2070 and 2080. Students with a score of 3, 4 or 5 on the Physics C Mechanics test will receive credit for PHYS 2130; students with a score of 3, 4 or 5 on the Physics C Electricity and Magnetism test will receive credit for PHYS 2140.

### **(1) Requirements for the Bachelor of Arts in Astronomy**

The B.A. in astronomy program consists of 40 hours of required astronomy and physics courses in the department of physics and astronomy, 15 hours of mathematics, and at least 9 additional hours in the natural sciences and mathematics, chosen with the Adviser's approval. This program is intended to provide the combination of fundamental physics, together with general and advanced astronomy, required for a career in astronomy or a related area. It also has the flexibility required by students who wish to pursue interdisciplinary studies or prepare for careers in teaching or other professions requiring a fundamental understanding of the physical sciences.

**Recommended introductory course:** PHYS 1910 is strongly recommended.

**Basic astronomy sequence:** The sequence ASTR 2010, 2020 (6 hours) is required.

**Advanced astronomy courses:** The advanced courses ASTR 3880, 4810, 4820 and 4880 (13 hours) are required.

**Fundamental physics sequence:** Either the sequence PHYS 2130-2140 (10 hours) or the sequence PHYS 2070-2080-2100 (12 hours) is required.

**Other required physics courses:** PHYS 3310, PHYS4920, PHYS 4950, and 6 additional hours of physics courses numbered 3000 or higher (11 hours).

**Required mathematics courses:** One of MATH 1830, 1850 or 1920, one of MATH 1840, 1860 or 1930, one of MATH 2850, 2880, or 2950, and MATH 3610 (15 hours) are required.

**Other courses in related areas:** At least 9 hours of other natural science courses must be taken, of which 3 hours must be major-level courses chosen from biology, chemistry, or environmental sciences, with the selection approved by the student's Adviser. Examples of appropriate choices include BIOL 2150, 2160, 2170 and 2180; CHEM 1230, 1240, 1280 and 1290; and EEES, 2010 and 2100.

### **(2) Requirements for the Bachelor of Arts in Physics**

The B.A. in physics consists of 34 hours in the department of physics and astronomy, 15 hours of mathematics, and at least 9 additional hours in the natural sciences and mathematics, chosen with the Adviser's approval. This program is intended to provide the flexibility required by students who wish to pursue interdisciplinary studies, or prepare for careers in teaching or other professions requiring a fundamental understanding of the physical sciences.

**Recommended introductory course:** PHYS 1910 is strongly recommended.

**Fundamental physics sequence:** Either the sequence PHYS 2130-2140 (10 hours)

or the sequence PHYS 2070-2080-2100 (12 hours) is required.

**Other required physics courses:** PHYS 3180, PHYS 3310, PHYS4920 and PHYS 4950.

**Elective courses in the major:** At least 16 hours of additional physics or astronomy courses numbered above 3000 are required.

**Required mathematics courses:** One of MATH 1830, 1850 or 1920, one of MATH 1840, 1860 or 1930, one of MATH 2850, 2880, or 2950, and MATH 3610 are required.

**Other courses in related areas:** At least 9 hours of other natural science courses must be taken, of which 3 hours must be major-level courses chosen from biology, chemistry, or environmental sciences, with the selection approved by the student's Adviser. Examples of appropriate choices include BIOL 2150, 2160, 2170 and 2180; CHEM 1230, 1240, 1280 and 1290; and EEES 2010 and 2100.

### **(3) Requirements for the Bachelor of Science in Physics**

The B.S. in physics consists of a core program that all students must complete and a choice of one concentration with additional requirements as listed below. The core program contains 34 hours of physics courses and 29 hours of related-area courses; the concentrations contain an additional 6-20 hours of physics, astronomy and related courses.

**Recommended introductory course:** PHYS 1910 is strongly recommended.

**Core physics courses:** PHYS 2130, 2140, 3310, 3410, 4210, 4230, 4240, 4310, 4920, 4950, and 4 hours of PHYS4910 are required. With department approval, a student may substitute PHYS 2070, 2080 and 2100 for PHYS 2130 and 2140.

**Related courses:** CHEM 1230 and 1280, EECS1500, one of MATH 1830, 1850 or 1920, one of MATH 1840, 1860, or 1930, one of MATH 1890, or 2890, one of MATH 2850, 2880, or 2950, one of MATH 2860, 3820, or 3880, MATH 3610, and one additional course (3-4 hours) chosen from major-level courses in biology or environmental sciences.

### **Concentrations**

The student must choose one of the following concentrations:

**Physics:** PHYS 3180, and either 4580 or 4780.

**Astrophysics:** ASTR 2010, 2020, 3880, 4810, 4820 and 4880.

**Applied Physics:** PHYS 3180, 3610, 4510, and either 4580 or 4780, plus three hours of appropriate courses from physics or engineering, chosen with the Adviser's approval.

**Biomedical Physics:** PHYS 3180, 4430, 4440, and either 4580 or 4780; and related courses BIOL 2150 and 2160 (which satisfies the related major-level course requirement above), plus KINE 2510, 2520, 2530 and 2540 (or the alternate sequence KINE 2460, 2470, 2560, and 2570).

In addition to the above requirements, students should consider the following recommended electives: MATH 4740 and 4750.

### **Honors in Physics and Astronomy**

Qualified juniors and seniors may be invited to work for the citation "honors in physics and astronomy."

**A. Admission:** The Honors Program in the department of physics and astronomy is open to physics majors and may be taken concurrently with College Honors. Admission to the program is based upon the student's academic achievement (at least a 3.0 GPA overall; at least a 3.3 GPA in the major), recommendations of previous instructors and an interview with the departmental honors officer. A petition for entrance into the program normally should be made before the end of

the sophomore year.

**B. Requirements:** In order to remain in the program and graduate with departmental honors, the students must maintain at least a 3.0 cumulative GPA and at least a 3.3 GPA in the major. In addition to the normal requirements for a physics undergraduate major, the student must successfully complete six hours of physics with honors in courses numbered above 3320\*, and six hours of math at or above the 3000 level. The written and oral reports required for PHYS 4920 will strongly influence the granting of the honors citation.

*\*ASTR 4810, 4820 may count toward this requirement.*

**Minor in Renewable Energy** (This minor is interdisciplinary)

The Minor in Renewable Energy (MRE) has been established as an interdisciplinary minor program. It is designed for students in the STEM areas majoring in the following departments: Physics and Astronomy, Chemistry, Environmental Sciences, Biology, Mathematics, MIME, Chemical and Environmental Engineering, Electrical Engineering and Computer Science, Civil Engineering and Bioengineering. Students with other majors can enroll in the MRE provided they complete the prerequisite courses. The goal of the minor is to expose students to quantitative analyses of the use of energy in human societies, its consequences and environmental impacts. A primary focus will be on the advantages and complexities of introducing renewable energy resources. Students will be required to take at least one course in the social, political, and economic ramifications of the use of energy in general and renewable energy in particular. An internship is required to enhance the practical training of students.

**Course requirements are as follows:** Students must complete at least 21 hours of coursework selected as follows: Four required courses

- PHYS 3400 Physical Principles of Energy Sources for Humans 3 credit hours
- EEES 2200/GEPL 2200 Climate Change 3 credit hours
- CHEM 3810 Chemistry of Sustainable Energy Resources 3 credit hours
- PHYS 4940 Internship in Renewable Energy 3 credit hours

Select one from

- PSC 4340 Environmental Policy 3 credit hours
- ECON 3240 Environmental Economics 3 credit hours

Select two of the following

- PHYS 4400 Varieties of Solar Energy 3 credit hours
- MIME 4980 Renewable Energy 3 credit hours
- CHEE/BIOE 4980 Biofuels 3 credit hours
- CHEE 4980 Fuel Cells and the Hydrogen Economy 3 credit hours

**Prerequisites:** PHYS 2080 General Physics II or higher, CHEM 1240 General Chemistry II, both courses under CHEE 4980 require MATH 1850 Single Variable Calculus I.