PHYSICS, BACHELOR OF SCIENCE

College of Letters & Science

From the smallest subatomic particles to atoms, molecules, stars, and galaxies, the study of physics is the study of what makes the universe work. Knowledge gained using atomic-scale microscopes and high-energy particle accelerators and nuclear reactors teaches us not only what holds the atomic nucleus together but also how proteins function and why stars shine.

The Program

The Department of Physics & Astronomy offers a Bachelor of Arts in Physics and two Bachelor of Science degree programs: in Physics (which also offers an emphasis in Astrophysics), and in Applied Physics. The A.B. degree provides broad coverage of classical and modern physics while permitting a broader liberal arts education than is possible with the other two programs. The B.S. degree in either Physics or Applied Physics should be followed by the student who plans to enter physics as a profession, and also provides excellent training for a wide variety of technical career options. The B.S. in Applied Physics provides the student with a solid introduction to a particular applied physics specialty. For the student who plans to enter the job market upon completing a B.S. degree, the applied physics orientation would be an asset. Either B.S. program provides a solid foundation in physics for the student interested in graduate work in either pure or applied physics.

Career Alternatives

Careers in physics and applied physics include research and development, either in universities, government laboratories, or industry; teaching in high schools, junior colleges, and universities; management and administration in industrial laboratories and in government agencies; and in production and sales in industry. A major in physics also provides a strong base for graduate-level work in such interdisciplinary areas as chemical physics, biophysics and medical physics, geophysics and environmental physics, astrophysics and astronomy, computer science, and materials science.

Program Variance

Similar courses from other departments may be substituted for courses in the depth subject matter requirements by obtaining prior written permission from the Undergraduate Curriculum Committee Chairperson.

Astronomy

In addition to the introductory Astronomy courses listed, upper division and graduate courses in Astronomy, Astrophysics and Cosmology are listed under Physics.

Graduate Study

The Department of Physics & Astronomy offers programs of study and research leading to M.S. and Ph.D. degrees. Further information regarding requirements for these three degrees, graduate research, teaching assistantships, and research assistantships may be obtained by writing to the Chairperson, Department of Physics, One Shields Avenue, University of California, Davis, CA 95616

The major requirements below are in addition to meeting University Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/university-degree-requirements/) & College Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/college-degree-requirements/); unless otherwise noted. The minimum number of units required for the Physics Bachelor of Science is 101.

### Physics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparatory Subject Matter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choose a series:</td>
<td>19-25</td>
<td></td>
</tr>
<tr>
<td>PHY 009HA &amp; PHY 009HB &amp; PHY 009HC &amp; PHY 009HD &amp; PHY 009HE</td>
<td>Honors Physics &amp; Honors Physics &amp; Honors Physics &amp; Honors Physics &amp; Honors Physics</td>
<td></td>
</tr>
<tr>
<td>PHY 040</td>
<td>Introduction to Computational Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 080</td>
<td>Experimental Techniques</td>
<td>4</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAT 021A</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MAT 021B</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MAT 021C</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MAT 021D</td>
<td>Vector Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MAT 022A</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MAT 022B</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Preparatory Subject Matter Subtotal</td>
<td>48-54</td>
<td></td>
</tr>
<tr>
<td><strong>Depth Subject Matter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHY 104A</td>
<td>Introduction to Mathematical Methods in Physics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 105A</td>
<td>Classical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 105B</td>
<td>Analytical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 110A</td>
<td>Electricity &amp; Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHY 110B</td>
<td>Electricity &amp; Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHY 110C</td>
<td>Electricity &amp; Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHY 112</td>
<td>Thermodynamics &amp; Statistical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 115A</td>
<td>Foundation of Quantum Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 115B</td>
<td>Applications of Quantum Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 102</td>
<td>Computational Laboratory in Physics (1 unit)</td>
<td>1-4</td>
</tr>
<tr>
<td>or PHY 104B</td>
<td>Computational Methods of Mathematical Physics</td>
<td></td>
</tr>
<tr>
<td><strong>Laboratory Requirement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choose PHY 122A or 122B or 116 series:</td>
<td>4-12</td>
<td></td>
</tr>
<tr>
<td>PHY 122A</td>
<td>Advanced Laboratory in Condensed Matter Physics</td>
<td></td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHY 122B</td>
<td>Advanced Laboratory in Particle Physics</td>
<td></td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHY 116A &amp; PHY 116B &amp; PHY 116C</td>
<td>Electronic Instrumentation and Electronic Instrumentation and Introduction to Computer-Based Experiments in Physics</td>
<td></td>
</tr>
</tbody>
</table>
Physics, Bachelor of Science

**Concentration Courses**

Choose two courses from one specialty and one course from a different specialty: 12

**General Relativity/Astrophysical Applications**
- PHY 154: Astrophysical Applications of Physics
- PHY 155: General Relativity

**Condensed Matter**
- PHY 140A: Introduction to Solid State Physics
- PHY 140B: Introduction to Solid State Physics

**Nuclear/Particle Physics**
- PHY 129A: Introduction to Nuclear Physics
- PHY 130A: Elementary Particle Physics
- PHY 130B: Elementary Particle Physics

**Additional Upper Division Physics Courses**

Additional upper division Physics courses¹, for a total of 15 upper-division Physics courses of 3 or more units each. With prior departmental approval, one course from mathematics, engineering, or natural science may be used to meet this requirement. May include only one from:

- PHY 194HA & PHY 194HB: Special Study for Honors Students
- PHY 195: Senior Thesis
- PHY 198: Directed Group Study (Must be taken for at least 3 units to count as an elective.)
- PHY 199: Special Study for Advanced Undergraduates (Must be taken for at least 3 units to count as an elective.)

Depth Subject Matter Subtotal: 53-76

**Total Units**: 101-130

1 Excluding PHY 160

### Astrophysics Emphasis

**Code** **Title** **Units**

**Preparatory Subject Matter**

**Physics**
- Choose a series: 19-25
  - PHY 009A: Classical Physics
  - PHY 009B: Classical Physics
  - PHY 009C: Classical Physics
  - PHY 009D: Modern Physics
  - PHY 009HA: Honors Physics
  - PHY 009HB: Honors Physics
  - PHY 009HC: Honors Physics
  - PHY 009HD: Honors Physics
  - PHY 009HE: Honors Physics
  - PHY 040: Introduction to Computational Physics 3
  - PHY 080: Experimental Techniques 4

**Mathematics**
- MAT 021A: Calculus 4
- MAT 021B: Calculus 4
- MAT 021C: Calculus 4
- MAT 021D: Vector Analysis 4
- MAT 022A: Linear Algebra 3

**MAT 022B**: Differential Equations 3

Preparatory Subject Matter Subtotal: 48-54

**Depth Subject Matter**

**Physics**
- PHY 104A: Introduction to Mathematical Methods in Physics 4
- PHY 105A: Classical Mechanics 4
- PHY 108: Optics 3
- PHY 108L: Optics Laboratory 1
- PHY 110A: Electricity & Magnetism 4
- PHY 110B: Electricity & Magnetism 4
- PHY 111: Thermodynamics & Statistical Mechanics 4
- PHY 115A: Foundation of Quantum Mechanics 4
- PHY 115B: Applications of Quantum Mechanics 4
- PHY 102: Computational Laboratory in Physics 1-4
- PHY 151: Stellar Structure & Evolution 4
- PHY 152: Galactic Structure & the Interstellar Medium 4
- PHY 153: Extragalactic Astrophysics 4
- PHY 156: Introduction to Cosmology 4

**Electives**

Choose two: 6-12

- PHY 105B: Analytical Mechanics
- PHY 110C: Electricity & Magnetism
- PHY 116A: Electronic Instrumentation
- PHY 129A: Introduction to Nuclear Physics
- PHY 130A: Elementary Particle Physics
- PHY 130B: Elementary Particle Physics
- PHY 150: Special Topics in Physics
- PHY 154: Astrophysical Applications of Physics
- PHY 155: General Relativity
- GEL 163: Planetary Geology & Geophysics

May include only one from:

- PHY 194HA & PHY 194HB: Special Study for Honors Students
- PHY 195: Senior Thesis
- PHY 198: Directed Group Study (Must be taken for at least 3 units to count as an elective.)
- PHY 199: Special Study for Advanced Undergraduates (Must be taken for at least 3 units to count as an elective.)

Depth Subject Matter Subtotal: 59-68

Recommended
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST 025</td>
<td>Introduction to Modern Astronomy &amp; Astrophysics</td>
<td>107-122</td>
</tr>
</tbody>
</table>

**Total Units:** 107-122