PHYSICS, BACHELOR OF SCIENCE

College of Letters & Science

The Major Program
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

Physics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHY 009A</td>
<td>Classical Physics</td>
<td></td>
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<tr>
<td>&amp; PHY 009B</td>
<td>and Classical Physics</td>
<td></td>
</tr>
<tr>
<td>&amp; PHY 009C</td>
<td>and Classical Physics</td>
<td></td>
</tr>
<tr>
<td>&amp; PHY 009D</td>
<td>and Modern Physics</td>
<td></td>
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<tr>
<td>PHY 009HA</td>
<td>Honors Physics</td>
<td></td>
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<tr>
<td>&amp; PHY 009HB</td>
<td>and Honors Physics</td>
<td></td>
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<tr>
<td>&amp; PHY 009HC</td>
<td>and Honors Physics</td>
<td></td>
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<tr>
<td>&amp; PHY 009HD</td>
<td>and Honors Physics</td>
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<td>&amp; PHY 009HE</td>
<td>and Honors Physics</td>
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<tr>
<td>PHY 040</td>
<td>Introduction to Computational Physics</td>
<td>3</td>
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<tr>
<td>PHY 080</td>
<td>Experimental Techniques</td>
<td>4</td>
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<tr>
<td>MAT 021A</td>
<td>Calculus</td>
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<tr>
<td>MAT 021B</td>
<td>Calculus</td>
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<tr>
<td>MAT 021C</td>
<td>Calculus</td>
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<tr>
<td>MAT 021D</td>
<td>Vector Analysis</td>
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<tr>
<td>MAT 022A</td>
<td>Linear Algebra</td>
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<td>MAT 022B</td>
<td>Differential Equations</td>
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Preparatory Subject Matter Subtotal 48-54

Depth Subject Matter

Physics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHY 104A</td>
<td>Introduction to Mathematical Methods in Physics</td>
<td>4</td>
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<tr>
<td>PHY 105A</td>
<td>Classical Mechanics</td>
<td>4</td>
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<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>
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<tr>
<td>PHY 115B</td>
<td>Applications of Quantum Mechanics</td>
<td>4</td>
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<tr>
<td>PHY 102</td>
<td>Computational Laboratory in Physics (1 unit)</td>
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<tr>
<td>or PHY 104B</td>
<td>Computational Methods of Mathematical Physics</td>
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Laboratory Requirement

Choose PHY 122A or 122B or 116 series:

<table>
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<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>PHY 122A</td>
<td>Advanced Laboratory in Condensed Matter Physics</td>
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<td>OR</td>
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<td></td>
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<tr>
<td>PHY 122B</td>
<td>Advanced Laboratory in Particle Physics</td>
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<tr>
<td>OR</td>
<td></td>
<td></td>
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<tr>
<td>PHY 116A</td>
<td>Electronic Instrumentation</td>
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<tr>
<td>&amp; PHY 116B</td>
<td>and Electronic Instrumentation</td>
<td></td>
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<tr>
<td>&amp; PHY 116C</td>
<td>and Introduction to Computer-Based Experiments in Physics</td>
<td></td>
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Concentration Courses

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

General Relativity/Astrophysical Applications
Physics, Bachelor of Science

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 courses\(^1\), 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 and 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

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### Astrophysics Emphasis

#### Preparatory Subject Matter

**Physics**

Choose a series:

PHY 009HA & PHY 009HB & PHY 009HC & PHY 009HD & PHY 009HE | Honors Physics and Honors Physics and Honors Physics and Honors Physics and Honors Physics
PHY 040 | Introduction to Computational Physics
PHY 080 | Experimental Techniques

**Mathematics**

MAT 021A | Calculus
MAT 021B | Calculus
MAT 021C | Calculus
MAT 021D | Vector Analysis
MAT 022A | Linear Algebra
MAT 022B | Differential Equations

Preparatory Subject Matter Subtotal | 48-54

### Depth Subject Matter

**Physics**

PHY 104A | Introduction to Mathematical Methods in Physics
PHY 105A | Classical Mechanics
PHY 108 | Optics
PHY 108L | Optics Laboratory
PHY 110A | Electricity & Magnetism
PHY 110B | Electricity & Magnetism
PHY 112 | Thermodynamics & Statistical Mechanics
PHY 115A | Foundation of Quantum Mechanics
PHY 115B | Applications of Quantum Mechanics
PHY 102 | Computational Laboratory in Physics
PHY 104B | Computational Methods of Mathematical Physics
PHY 151 | Stellar Structure & Evolution
PHY 152 | Galactic Structure & the Interstellar Medium
PHY 153 | Extragalactic Astrophysics
PHY 156 | Introduction to Cosmology
PHY 157 | Astronomy Instrumentation & Data Analysis Laboratory

Electives

Choose two:

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 and 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

AST 025 | Introduction to Modern Astronomy & Astrophysics

Total Units | 107-122