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 040</td>
<td>Introduction to Computational Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 080</td>
<td>Experimental Techniques</td>
<td>4</td>
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</table>

#### Preparatory Subject Matter

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHY 09A</td>
<td>Classical Physics</td>
<td>19-25</td>
</tr>
<tr>
<td>&amp; PHY 09B</td>
<td>Classical Physics</td>
<td></td>
</tr>
<tr>
<td>&amp; PHY 09C</td>
<td>Classical Physics</td>
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</tr>
<tr>
<td>&amp; PHY 09D</td>
<td>Modern Physics</td>
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</tr>
<tr>
<td>PHY 09HA</td>
<td>Honors Physics</td>
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<td>&amp; PHY 09HB</td>
<td>Honors Physics</td>
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<td>&amp; PHY 09HC</td>
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<tr>
<td>&amp; PHY 09HD</td>
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<tr>
<td>&amp; PHY 09HE</td>
<td>Honors Physics</td>
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#### Depth Subject Matter

<table>
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<th>Code</th>
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<th>Units</th>
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<tbody>
<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>
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<tr>
<td>PHY 102</td>
<td>Computational Laboratory in Physics (1 unit)</td>
<td>1-4</td>
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Laboratory Requirement

Choose PHY 122A or 122B or 116 series:

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHY 122A</td>
<td>Advanced Laboratory in Condensed Matter Physics</td>
<td>4-12</td>
</tr>
<tr>
<td>OR</td>
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<tr>
<td>PHY 122B</td>
<td>Advanced Laboratory in Particle Physics</td>
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<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHY 116A</td>
<td>Electronic Instrumentation</td>
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<tr>
<td>&amp; PHY 116B</td>
<td>Electronic Instrumentation</td>
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<tr>
<td>&amp; PHY 116C</td>
<td>Introduction to Computer-Based Experiments in Physics</td>
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#### Concentration Courses

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

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

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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>PHY 009A</td>
<td>Classical Physics</td>
<td>19-25</td>
</tr>
</tbody>
</table>
& PHY 009B  and Classical Physics
& PHY 009C  and Classical Physics
& PHY 009D  and Modern Physics

PHY 009HA  Honors Physics
& PHY 009HB  and Honors Physics
& PHY 009HC  and Honors Physics
& PHY 009HD  and Honors Physics
& PHY 009HE  and 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

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 1112  Thermodynamics & Statistical Mechanics  4
PHY 1115  Foundation of Quantum Mechanics  4
PHY 115B  Applications of Quantum Mechanics  4
PHY 102  Computational Laboratory in Physics  1-4
or PHY 104B  Computational Methods of Mathematical Physics
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

Laboratory Requirement

Choose one:

PHY 122A  Advanced Laboratory in Condensed Matter Physics  4
PHY 122B  Advanced Laboratory in Particle Physics
PHY 157  Astronomy Instrumentation & Data Analysis Laboratory

Electives

Choose two:

PHY 105B  Analytical Mechanics  6-12
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

AST 025  Introduction to Modern Astronomy & Astrophysics

Total Units  107-122