Physics

Physics is the scientific study of the fundamental principles governing the behavior of matter and the interaction of matter and energy. Mathematics is used to describe fundamental physical principles, the behavior of matter, and the interactions of matter and energy. As the most fundamental of sciences, physics provides a foundation for other scientific fields as well as the underpinnings of modern technology. The Physics department is unique because of the breadth of its faculty expertise and research, and the relatively intimate size of its classes above the introductory level. Physics concentrators may choose to pursue either the A.B. or the more intensive Sc.B. degree. Course work on either path covers a broad base of topics (for example, electricity and magnetism, classical and quantum mechanics, thermodynamics, and statistical mechanics). The Sc.B. degree requires additional advanced topics as well as a senior thesis project.

Standard concentration for the A.B. degree

Select one of the following Series:

PHYS 0070 Analytical Mechanics
+ PHYS 0160 and Introduction to Relativity and Quantum Physics

PHYS 0030 Basic Physics A
+ PHYS 0040 and Basic Physics B

PHYS 0050 Foundations of Mechanics
+ PHYS 0060 and Foundations of Electromagnetism and Modern Physics

PHYS 0470 Electricity and Magnetism

PHYS 0500 Advanced Classical Mechanics

PHYS 0560 Experiments in Modern Physics

PHYS 1410 Quantum Mechanics A

PHYS 1530 Thermodynamics and Statistical Mechanics

One additional 1000-level course or a mathematics course beyond the introductory level.

Total Credits 8

Standard program for the Sc.B. degree

Prerequisites:

Select one of the following series:

PHYS 0070 Analytical Mechanics
+ PHYS 0160 and Introduction to Relativity and Quantum Physics

PHYS 0050 Foundations of Mechanics
+ PHYS 0060 and Foundations of Electromagnetism and Modern Physics

Select one of the following:

MATH 0190 Advanced Placement Calculus (Physics/Engineering)

Or MATH 0090, MATH 0100

Program:

PHYS 0470 Electricity and Magnetism

PHYS 0500 Advanced Classical Mechanics

PHYS 0560 Experiments in Modern Physics

PHYS 1410 Quantum Mechanics A

PHYS 1420 Quantum Mechanics B

PHYS 1510 Advanced Electromagnetic Theory

PHYS 1530 Thermodynamics and Statistical Mechanics

PHYS 1560 Modern Physics Laboratory

PHYS 1980 Undergraduate Research in Physics

One additional 1000 or 2000 level course in related fields of science chosen by the student with agreement of his or her advisor.

Four Mathematics courses beyond MATH 0190 or 0090, 0100 including choices from Applied Mathematics

PHYS 1990 Senior Conference Course

Total Credits 18

Honors

Candidates for honors in physics will be expected to pursue a more rigorous and extensive program than those merely concentrating in the subject. In addition they will be required to begin an honors thesis during the seventh semester and to complete it (as part of PHYS 1990) during the eighth semester. Honors candidates are also expected to take a special oral examination on the thesis at the end of the eighth semester. Further details about the program may be obtained from the chair of the department or the departmental honors advisor.

Astrophysics Track for the Sc.B. degree

Prerequisites:

Select one of the following Series:

PHYS 0070 Analytical Mechanics
+ PHYS 0160 and Introduction to Relativity and Quantum Physics

PHYS 0050 Foundations of Mechanics
+ PHYS 0060 and Foundations of Electromagnetism and Modern Physics

PHYS 0270 Introduction to Astronomy

Select one of the following Series:

MATH 0170 Advanced Placement Calculus
+ MATH 0180 and Intermediate Calculus

MATH 0190 Advanced Placement Calculus (Physics/Engineering)
+ MATH 0200 and Intermediate Calculus (Physics/Engineering)

MATH 0350 Honors Calculus (or equivalent)

PHYS 0470 Electricity and Magnetism

Program:

MATH 0520 Linear Algebra

or MATH 0540 Honors Linear Algebra

or PHYS 0720 Methods of Mathematical Physics

Select one of the following Math courses:

APMA 0330 Methods of Applied Mathematics I, II

APMA 0340 Methods of Applied Mathematics I, II

APMA 0350 Applied Ordinary Differential Equations

APMA 0360 Applied Partial Differential Equations I

MATH 1110 Ordinary Differential Equations

MATH 1120 Partial Differential Equations

PHYS 0500 Advanced Classical Mechanics

PHYS 0560 Experiments in Modern Physics

PHYS 1410 Quantum Mechanics A

PHYS 1530 Thermodynamics and Statistical Mechanics

Three of the following:

PHYS 1100 Introduction to General Relativity

PHYS 1250 Stellar Structure and the Interstellar Medium
### Biological Physics Track for the Sc.B. degree

**Foundations of Physics**
- PHYS 0070 Analytical Mechanics 1
- or PHYS 0050 Foundations of Mechanics 1
- or ENGN 0040 Dynamics and Vibrations 1
- PHYS 0160 Introduction to Relativity and Quantum Physics 1
- or PHYS 0060 Foundations of Electromagnetism and Modern Physics 1
- PHYS 0470 Electricity and Magnetism 1
- PHYS 0500 Advanced Classical Mechanics 1
- PHYS 1410 Quantum Mechanics A 1
- PHYS 1530 Thermodynamics and Statistical Mechanics 1

Select one of the following Series: 1

#### Series A
- PHYS 0720 Methods of Mathematical Physics 1

#### Series B
- Select one of the following:
  - APMA 0330 Methods of Applied Mathematics I, II 1
  - APMA 0350 Applied Ordinary Differential Equations 1
  - MATH 1110 Ordinary Differential Equations 1
- And select one of the following:
  - MATH 0180 Intermediate Calculus 1
  - MATH 0200 Intermediate Calculus (Physics/Engineering) 1
  - MATH 0350 Honors Calculus 1
  - MATH 0520 Linear Algebra 1
  - MATH 0540 Honors Linear Algebra 1

#### Basic Biology and Chemistry
- BIOL 0200 The Foundation of Living Systems (or placement out of BIOL 0200) 1
- BIOL 0500 Cell and Molecular Biology 1
- CHEM 0330 Equilibrium, Rate, and Structure 1

#### Advanced Biophysical Topics and Techniques
- PHYS 1610 Biological Physics 1
- PHYS 1990 Senior Conference Course 1

**Elective Courses (four chosen from the following list, with at least two 1000-level courses, or additional courses approved by the concentration advisor):**
- APMA 0360 Applied Partial Differential Equations I 1
- APMA 0410 Mathematical Methods in the Brain Sciences 1
- APMA 0650 Essential Statistics 1
- APMA 1070 Quantitative Models of Biological Systems 1
- APMA 1080 Inference in Genomics and Molecular Biology 1
- BIOL 0280 Biochemistry 1
- BIOL 0470 Genetics 1

- BIOL 1050 Biology of the Eukaryotic Cell 1
- BIOL 1200 Protein Biophysics and Structure 1
- BIOL 1270 Advanced Biochemistry 1
- BIOL 1870 Techniques and Clinical Applications in Pathobiology 1
- CHEM 0350 Organic Chemistry 1
- CHEM 0360 Organic Chemistry 1
- MATH 0090 Introductory Calculus, Part I 1
- MATH 0170 Advanced Placement Calculus 1
- MATH 0190 Advanced Placement Calculus (Physics/Engineering) 1
- MATH 1610 Probability 1
- MATH 1620 Mathematical Statistics 1
- PHYS 0560 Experiments in Modern Physics 1
- PHYS 1510 Advanced Electromagnetic Theory 1
- PHYS 1560 Modern Physics Laboratory 1
- PHYS 2620F Selected Topics in Molecular Biophysics 1
- PHYS 1990 Senior Conference Course 2

**Total Credits:** 18

1 A senior thesis is required. This is to be prepared in connection with under the direction of a faculty supervisor. The topic may be in a related department or of interdisciplinary nature. In any event, a dissertation must be submitted.

### Mathematical Physics Track for the A.B. degree

**Prerequisites:**
- MATH 0090 Introductory Calculus, Part I 1
  - or MATH 0100 Introductory Calculus, Part II 1
  - or MATH 0190 Advanced Placement Calculus (Physics/Engineering) 1
- PHYS 0050 Foundations of Mechanics 1
  - or PHYS 0070 Analytical Mechanics 1

**Mathematics Courses:**
- MATH 0180 Intermediate Calculus 1
  - or MATH 0200 Intermediate Calculus (Physics/Engineering) 1
  - or MATH 0350 Honors Calculus 1
- MATH 0520 Linear Algebra 1
  - or MATH 0540 Honors Linear Algebra 1
- MATH 1110 Ordinary Differential Equations 1

Select at least one of the following:
- MATH 1060 Differential Geometry 1
- MATH 1120 Partial Differential Equations 1
- MATH 1610 Probability 1

**Physics Courses:**
- PHYS 0060 Foundations of Electromagnetism and Modern Physics 1
  - or PHYS 0160 Introduction to Relativity and Quantum Physics 1
- PHYS 0470 Electricity and Magnetism 1
- PHYS 0500 Advanced Classical Mechanics 1
- PHYS 0560 Experiments in Modern Physics 1

Select at least two of the following:
- PHYS 1410 Quantum Mechanics A 1
- PHYS 1420 Quantum Mechanics B 1
- PHYS 1510 Advanced Electromagnetic Theory 1
- PHYS 1530 Thermodynamics and Statistical Mechanics 1

**Total Credits:** 17-18

1 Select Series A alone or two from Series B as indicated.

2 A senior thesis is required. This is to be prepared in connection with under the direction of a faculty supervisor. The topic may be in a related department or of interdisciplinary nature. In any event, a dissertation must be submitted.
Concentrators are required to take at least one course in mathematics and one in physics in each of their last two semesters.

### Mathematical Physics Track for the Sc.B. degree

**Prerequisites:**

Select one of the following series:

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 0070 &amp; PHYS 0160</td>
<td>Analytical Mechanics and Introduction to Relativity and Quantum Physics</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 0050 &amp; PHYS 0060</td>
<td>Foundations of Mechanics and Foundations of Electromagnetism and Modern Physics</td>
<td>1-2</td>
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Select one of the following:

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<tr>
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<tbody>
<tr>
<td>MATH 0190</td>
<td>Advanced Placement Calculus (Physics/Engineering)</td>
<td>1-2</td>
</tr>
<tr>
<td>MATH 0090 &amp; MATH 0100</td>
<td>Introductory Calculus, Part I and Introductory Calculus, Part II</td>
<td>1-2</td>
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**Required courses:**

<table>
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<th>Title</th>
<th>Credits</th>
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<td>PHYS 0470</td>
<td>Electricity and Magnetism</td>
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<tr>
<td>PHYS 0500</td>
<td>Advanced Classical Mechanics</td>
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<td>PHYS 0560</td>
<td>Experiments in Modern Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1410</td>
<td>Quantum Mechanics A</td>
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<tr>
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<tr>
<td>or MATH 0350</td>
<td>Honors Calculus</td>
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<tr>
<td>MATH 0520</td>
<td>Linear Algebra</td>
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<td>or MATH 0540</td>
<td>Honors Linear Algebra</td>
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<tr>
<td>or PHYS 0720</td>
<td>Methods of Mathematical Physics</td>
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</tr>
<tr>
<td>MATH 1530</td>
<td>Abstract Algebra</td>
<td>1</td>
</tr>
</tbody>
</table>

Four additional 1000 or 2000 level Physics courses: 4

Two additional 1000 or 2000 level Math courses: 2

PHYS 1990 | Senior Conference Course | 1       |

Total Credits: 18-20

1 A senior thesis is required. This is to be prepared in connection with under the direction of a faculty supervisor.
Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

Helvetica was used instead of Arial.

The editor may contact Leepfrog for a draft with the correct fonts in place.