Undergraduate Degree Programs

Physics  Astrophysics
Astronomy  Engineering Physics
Chemical Physics  Mathematical Physics
Biological Physics  Physics & Philosophy

Student Groups

physicsdug@brown.edu  wise@brown.edu

Vibrant Community - Research Opportunities -
Journal Clubs - Weekly Colloquium & Seminars
Outreach Opportunities - Art Show - Poster Session -
Annual Picnic - And more

www.physics.brown.edu
Physics Concentration Requirements

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 mechanics, thermodynamics, and statistical mechanics. The Sc.B. degree requires additional advanced topics as well as a senior thesis project.

Standard program for the Sc.B. degree

Select one of the following Series:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHYS 0070</td>
<td>Analytical Mechanics</td>
<td>2</td>
</tr>
<tr>
<td>&amp; PHYS 0160</td>
<td>and Introduction to Relativity and Quantum Physics</td>
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<tr>
<td>PHYS 0030</td>
<td>Basic Physics</td>
<td>1</td>
</tr>
<tr>
<td>&amp; PHYS 0040</td>
<td>and Basic Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS 0050</td>
<td>Foundations of Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>&amp; PHYS 0060</td>
<td>and Foundations of Electromagnetism and Modern Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS 0470</td>
<td>Electricity and Magnetism</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 0500</td>
<td>Advanced Classical Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 0560</td>
<td>Experiments in Modern Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1410</td>
<td>Quantum Mechanics A</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1530</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td>1</td>
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</tbody>
</table>

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

Total Credits 8

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:

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<td></td>
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<td>Foundations of Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>&amp; PHYS 0060</td>
<td>and Foundations of Electromagnetism and Modern Physics</td>
<td></td>
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<tbody>
<tr>
<td>MATH 0190</td>
<td>Advanced Placement Calculus (Physics/ Engineering)</td>
<td>1</td>
</tr>
<tr>
<td>Or MATH 0090, MATH 0100</td>
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Program:

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<tr>
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<tr>
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</tr>
<tr>
<td>PHYS 0500</td>
<td>Advanced Classical Mechanics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 0560</td>
<td>Experiments in Modern Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1410</td>
<td>Quantum Mechanics A</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1420</td>
<td>Quantum Mechanics B</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1510</td>
<td>Advanced Electromagnetic Theory</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1530</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td>1</td>
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Three of the following:

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>PHYS 1100</td>
<td>Introduction to General Relativity</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1250</td>
<td>Stellar Structure and the Intergalactic Medium</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1270</td>
<td>Extragalactic Astronomy and High-Energy Astrophysics</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Credits 18
PHYS 1280  Introduction to Cosmology  
Two additional 1000- or 2000-level courses in physics or a related field  
which are not listed as requirements.  
PHYS 1990  Senior Conference Course  

Total Credits  

A senior thesis is required. This is to be prepared in connection 
with 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.

Biological Physics Track for the Sc.B. degree

Foundations of Physics
PHYS 0070  Analytical Mechanics  
or PHYS 0050  Foundations of Mechanics  
or ENGN 0040  Dynamics and Vibrations  
PHYS 0160  Introduction to Relativity and Quantum Physics  
or PHYS 0080  Foundations of Electromagnetism and Modern Physics  
PHYS 0470  Electricity and Magnetism  
PHYS 0500  Advanced Classical Mechanics  
PHYS 1410  Quantum Mechanics A  
PHYS 1530  Thermodynamics and Statistical Mechanics  

Select one of the following Series:  

Series A  
PHYS 0720  Methods of Mathematical Physics  

Series B  
Select one of the following:  

APMA 0330  Methods of Applied Mathematics I, II  
APMA 0350  Applied Ordinary Differential Equations  
MATH 1110  Ordinary Differential Equations  
And select one of the following:  

MATH 0180  Intermediate Calculus  
MATH 0200  Intermediate Calculus (Physics/Engineering)  
MATH 0350  Honors Calculus  
MATH 0520  Linear Algebra  
MATH 0540  Honors Linear Algebra

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

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

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  Methods of Applied Mathematics I, II  
APMA 0410  Mathematical Methods in the Brain Sciences  
APMA 0650  Essential Statistics  
APMA 1070  Quantitative Models of Biological Systems  
APMA 1080  Inference in Genomics and Molecular Biology  
BIOL 0280  Introductory Biochemistry  
BIOL 0470  Genetics  
BIOL 1050  Biology of the Eukaryotic Cell  
BIOL 1200  Protein Biophysics and Structure  
BIOL 1270  Advanced Biochemistry  
BIOL 1870  Techniques in Pathobiology  
CHEM 0350  Organic Chemistry  
CHEM 0360  Organic Chemistry  

MATH 0090  Introductory Calculus, Part I  
MATH 0170  Advanced Placement Calculus  
MATH 0190  Advanced Placement Calculus (Physics/Engineering)  
MATH 1810  Probability  
MATH 1820  Mathematical Statistics  
PHYS 0560  Experiments in Modern Physics  
PHYS 1510  Advanced Electromagnetic Theory  
PHYS 1580  Modern Physics Laboratory  
PHYS 2620F  Selected Topics in Molecular Biophysics  
PHYS 1990  Senior Conference Course  

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 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  
or MATH 0100  Introductory Calculus, Part II  
or MATH 0190  Advanced Placement Calculus (Physics/Engineering)  
PHYS 0050  Foundations of Mechanics  
or PHYS 0070  Analytical Mechanics  

Mathematics Courses  
MATH 0180  Intermediate Calculus  
or MATH 0200  Intermediate Calculus (Physics/Engineering)  
or MATH 0350  Honors Calculus  
MATH 0520  Linear Algebra  
or MATH 0540  Honors Linear Algebra  
MATH 1110  Ordinary Differential Equations  
Select at least one of the following:  

MATH 1060  Differential Geometry  
MATH 1120  Partial Differential Equations  
MATH 1610  Probability

Physics Courses  
PHYS 0060  Foundations of Electromagnetism and Modern Physics  
or PHYS 0160  Introduction to Relativity and Quantum Physics  
PHYS 0470  Electricity and Magnetism  
PHYS 0500  Advanced Classical Mechanics  
PHYS 0560  Experiments in Modern Physics  
Select at least two of the following:  

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  

Total Credits 12

1 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:  

2
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: 1-2
MATH 0180 Advanced Placement Calculus (Physics/Electrical Engineering)
MATH 0090 Introductory Calculus, Part I
& MATH 0100 and Introductory Calculus, Part II

Required courses:
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
MATH 0180 Intermediate Calculus
& MATH 0200 and Intermediate Calculus (Physics/Engineering)
or MATH 0350 Honors Calculus
MATH 0520 Linear Algebra
or MATH 0540 Honors Linear Algebra
MATH 1530 Abstract Algebra
Four additional 1000 or 2000 level Physics courses 4
Two additional 1000 or 2000 level Math courses 2
PHYS 1960 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.

Physics and Philosophy Concentration Requirements

The Physics and Philosophy concentration is for students with a deep interest in physics who do not need to acquire the laboratory and computational skills of a professional physicist. The concentration allows students to grapple with computational problems and deepen their investigation of conceptual and epistemological issues. By the end of the program, concentrators possess an excellent conceptual understanding of the most philosophically interesting physics, relativity and quantum mechanics.

This concentration should prepare a student either for graduate study, especially in a history and philosophy of science (HPS) program, or for employment in science education or journalism. Other professions such as law and medicine will look favorably on such concentrators for having versatile interests and being able to master difficult material. The concentration may serve as an excellent preparation for a law school since physics and philosophy both exercise a rigorous approach to problems of immediate relevance to life but at the same time assume two complimentary and sometimes competing viewpoints.

Advising

Concentration advisors from the Departments of Physics and Philosophy will guide students working towards the A.B. degree.

Curriculum

The curriculum builds around the fields of physics that have had the biggest impact on philosophy, especially Quantum Physics, and the fields of philosophy most relevant for physics, such as Epistemology, Metaphysics and Philosophy of Physics. It is strongly recommended that students complete at least one relevant history course.

There are 11 required courses (5 in Physics, 5 in Philosophy or History, one course in mathematics) and a final project. The choice of the courses is dictated by the following considerations. The field of physics with both deepest philosophical implications and deepest influence on the rest of physics is Quantum Mechanics. Thus, a 1000-level course in Quantum Mechanics or a closely related field such as Statistical Mechanics is indispensable. The second field of physics most relevant for the concentration is Relativity. This field touches upon and serves as a foundation for a broad list of subjects with major philosophical implications of their own, for example: PHYS 1170, PHYS 1280, PHYS 1510, PHYS 1100. This requires another 1000-level physics course in the concentration. 1000-level Physics courses cannot be taken without certain preliminary work, most importantly, PHYS 0470, which serves as a prerequisite for most higher-level physics courses and which relies in turn on PHYS 0180 or PHYS 0050. Another lower-level physics course is necessary for a student to develop familiarity with the tools which have been employed in producing the physics knowledge.

A natural introduction into philosophy of physics comes from a course in Early Modern Philosophy. To a large extent, Early Modern Philosophy was shaped by scholars who combined interest in philosophy and physics (e.g., Rene Descartes, Blaise Pascal, Gottfried Wilhelm Leibniz). The influence of the XVII century physics revolution on other central figures such as Kant is unquestionable. Early Modern Philosophy sets an intellectual stage for many subsequent developments in the Philosophy of Physics and directly addresses some of the most perplexing issues like the connection (or lack thereof) between physics and religion. The core of the Philosophy requirement involves two courses in Epistemology, Metaphysics and Philosophy of Science. One course in this field would not be sufficient due to its very broad nature. Students are strongly advised to take a relevant History course. This requirement can be substituted by an additional philosophy course to reflect interests of those students who want a deeper background in Epistemology, Metaphysics and Philosophy of Science or have other related interests such as Ancient Natural Philosophy.

In addition to the above philosophy courses, PHIL 0210 (Science, Perception, and Reality) serves as a gateway into the concentration. It may be substituted by other relevant courses such as PHYS 0100 (Flat Earth to Quantum Uncertainty: On the Nature and Meaning of Scientific Explanation).

A course in calculus is a prerequisite for most physics and some philosophy classes.

Required courses for the A.B. degree are listed below:

Physics Courses

Select one of the following introductory courses in Modern Physics: 1
PHYS 0050 Foundations of Electromagnetism and Modern Physics
PHYS 0160 Introduction to Relativity and Quantum Physics
One course in Special Relativity and Classical Field Theory: 1
PHYS 0470 Electricity and Magnetism
Select one of the following in Methods of Experimental and Theoretical physics:
PHYS 0500 Advanced Classical Mechanics
PHYS 0560 Experiments in Modern Physics
Select one of the following in Quantum Mechanics and its applications 1
PHYS 1410 Quantum Mechanics A
PHYS 1530 Thermodynamics and Statistical Mechanics
One more 1000-level Physics course 1

Philosophy Courses

Select one of the following gateway courses: 1
PHIL 0210 Science, Perception and Reality
PHIL 0100 Critical Reasoning
Select one of the following courses in Early Modern Philosophy: 1
PHIL 0360 Early Modern Philosophy
PHIL 1700 British Empiricists
PHIL 1710 17th Century Continental Rationalism
PHIL 1720 Kant: The Critique of Pure Reason
Select two of the following courses in Epistemology, Metaphysics and Philosophy of Science: 2
PHIL 1310 Myth and the Origins of Science
PHIL 1590 Philosophy of Science
PHIL 1610 Philosophy of Relativity Physics
PHIL 1620 Philosophy of Quantum Mechanics
PHIL 1630 Mathematical Logic
PHIL 1660 Metaphysics
PHIL 1670 Time
PHIL 1750 Epistemology
PHIL 1850 Philosophical Logic

History Courses
Select one of the following courses in History of Science: 1
HIST 0522N Reason, Revolution and Reaction in Europe
HIST 1825M Science at the Crossroads
HIST 1976I The World of Isaac Newton

Calculus
Select one of the following:
MATH 0180 Intermediate Calculus
MATH 0200 Intermediate Calculus (Physics/Engineering)
MATH 0350 Honors Calculus

Final Project
Select one of the following:
PHIL 1990 Independent Studies
PHYS 1990 Senior Conference Course
A course from the PHIL 0990 Senior Seminar series
Any graduate seminar in Philosophy

Total Credits 12
1 Or one more Philosophy course.

Honors
Seniors wishing to earn honors by presenting a senior honors thesis should consult their concentration advisor during their sixth semester or at the start of the seventh semester concerning procedures and requirements. Students may earn honors by presenting a senior thesis judged to be of honors quality by two readers. In addition to completing the usual nonhonors requirements, the student should also have a grade point average of over 3.4 in physics, philosophy and history of science courses (of which at least five must be taken for a letter grade). Honors theses are usually prepared over a period of two semesters with an advisor from the Department of Physics or the Department of Philosophy.

Chemical Physics Concentration Requirements
Chemical Physics is an interdisciplinary field at the crossroads of chemistry and physics and is administered jointly by the two departments. The concentration provides students with a broad-based understanding in fundamental molecular sciences, as well as a background for graduate studies in physical chemistry, chemical physics, or molecular engineering. Concentrators are required to take twenty courses in chemistry, physics, and mathematics, although approved courses in applied mathematics, biology, computer science, geological sciences, or engineering may be substitutes. Chemical Physics concentrators are also advised to take at least six courses in the humanities and social sciences. Chemical Physics concentrators at all levels (first-year through seniors) are actively involved in research with faculty members in both departments.

Standard program for the Sc.B. degree
Twenty-one semester courses 1 in chemistry, physics, and mathematics, with a minimum of four semester courses in mathematics. Core courses are:

CHEM 0330 Equilibrium, Rate, and Structure
CHEM 0350 Organic Chemistry
CHEM 0500 Inorganic Chemistry
CHEM 1140 Physical Chemistry: Quantum Chemistry

PHYS 0070 Analytical Mechanics
PHYS 0160 Introduction to Relativity and Quantum Physics
PHYS 0470 Electricity and Magnetism
Select one of the following laboratory courses:
CHEM 1160 Physical Chemistry Laboratory
PHYS 0560 Experiments in Modern Physics
PHYS 1560 Modern Physics Laboratory
Select one course in statistical mechanics:
CHEM 1150 Physical Chemistry: Thermodynamics and Statistical Mechanics
PHYS 1530 Thermodynamics and Statistical Mechanics
MATH 0190 Advanced Placement Calculus (Physics/Engineering)
MATH 0200 Intermediate Calculus (Physics/Engineering)
MATH 0520 Linear Algebra

Seven courses, primarily at the 1000 or 2000 level, in chemistry or physics.
Select two semesters of independent study:
CHEM Undergraduate Research
0970/0980
PHYS 1990 Senior Conference Course

Total Credits 21
1 Other approved courses in applied mathematics, biology, computer science, geological sciences, or engineering may be substituted for some of the twenty-one.
Students are advised to take at least six courses in the humanities and social sciences.

Engineering and Physics Concentration Requirements
The Sc.B. program in Engineering and Physics is sponsored jointly by the School of Engineering and the Department of Physics. The program is designed to ensure that students take a significant portion of the usual curriculum in Engineering and in Physics, obtain substantial laboratory experience, and take several upper-level elective courses, focusing on applied science. Students may take either the standard Physics or Engineering programs during their freshman and sophomore years and then switch to this combined program. The Sc.B. degree program in Engineering and Physics is not accredited by ABET.

The following standard program assumes that a student begins mathematics courses at Brown with MATH 0170 or its equivalent. Students who begin in MATH 0200 can substitute an additional science, engineering or higher-level mathematics course for the MATH 0170 or MATH 0180 requirement. To accommodate the diverse preparation of individual students, variations of the following sequences and their prerequisites are possible with permission of the appropriate concentration advisor and the instructors involved. We recommend that each student’s degree program be submitted for prior approval (typically in semester four) and scrutinized for compliance (in semester seven) by one faculty member from the Department of Physics and one faculty member from the School of Engineering.

Select one of the following two course sequences:
ENGN 0050 & ENGN 0060 Foundations of Mechanics & Foundations of Electromagnetism and Modern Physics
PHYS 0070 & PHYS 0160 Analytical Mechanics & Introduction to Relativity and Quantum Physics
MATH 0190 Advanced Placement Calculus (Physics/Engineering)
MATH 0170 Advanced Placement Calculus
MATH 0200 Intermediate Calculus (Physics/Engineering)
or MATH 0160 Intermediate Calculus
or MATH 0350 Honors Calculus
Select three additional higher-level math, applied math, or mathematical physics (PHYS 0720) courses.
CSCI 0040 Introduction to Scientific Computing and Problem Solving
or CSCI 0150 Introduction to Object-Oriented Programming and Computer Science
or CSCI 0170 Computer Science: An Integrated Introduction
or CSCI 0190 Accelerated Introduction to Computer Science
ENGN 0510 Electricity and Magnetism
or PHYS 0470 Electricity and Magnetism
ENGN 1560 Applied Electromagnetics
or PHYS 1510 Advanced Electromagnetic Theory
PHYS 0500 Advanced Classical Mechanics
or ENGN 1370 Advanced Engineering Mechanics
PHYS 1410 Quantum Mechanics A
PHYS 1420 Quantum Mechanics B
PHYS 1530 Thermodynamics and Statistical Mechanics
or ENGN 0720 Thermodynamics
ENGN 1620 Analysis and Design of Electronic Circuits
or ENGN 0310 Mechanics of Solids and Structures
or ENGN 0810 Fluid Mechanics
or PHYS 1600 Computational Physics
ENGN 0410 Materials Science
or ENGN 1690 Photonics and Applications
or PHYS 0560 Experiments in Modern Physics
PHYS 1560 Modern Physics Laboratory
or ENGN 1590 Introduction to Semiconductors and Semiconductor Electronics
or an approved 2000-level engineering or physics course.
A thesis under the supervision of a physics or engineering faculty member:
PHYS 1990 Senior Conference Course
or ENGN 1970 Independent Studies in Engineering
or ENGN 1971 Independent Study in Engineering
* Students are also encouraged to take courses dealing with the philosophical, ethical, or political aspects of science and technology.

Total Credits 19

Astronomy Concentration Requirements
Along with Greek, Latin, and Mathematics, Astronomy counts as one of the oldest continuously taught subjects in the Brown curriculum. It is the study of the properties of stars, galaxies, and the Universe, and as such combines elements from the disciplines of both Physics and Planetary Geology. Students pursuing this concentration complete introductory coursework in classical mechanics, relativity, and astrophysics, along with mathematics and electromagnetism. They go on to complete courses in stellar and extragalactic astrophysics as well as cosmology. Facilities available to concentrators include the historic Ladd Observatory.

Standard concentration for the A.B. degree
Eleven or twelve courses are required (depending on the satisfaction of prerequisites).
Prerequisites
PHYS 0070 Analytical Mechanics
PHYS 0160 Introduction to Relativity and Quantum Physics
PHYS 0270 Introduction to Astronomy
Select one of the following Series: 1-2

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
Select one of the following mathematics courses: 1
PHYS 0070 Analytical Mechanics
& PHYS 0160 Introduction to Relativity and Quantum Physics
PHYS 0190 Advanced Placement Calculus (Physics/Engineering)
& PHYS 0200 and Intermediate Calculus (Physics/Engineering)
MATH 0350 Honors Calculus (or equivalent)

Select two of the following astrophysics courses: 2
PHYS 1100 Introduction to General Relativity
PHYS 1250 Stellar Structure and the Interstellar Medium
PHYS 1270 Extragalactic Astronomy and High-Energy Astrophysics
PHYS 1280 Introduction to Cosmology

Three additional 1000- or 2000-level courses in physics or a related field, suggestions: 3
APMA 1670 Statistical Analysis of Time Series
ENGN 1860 Advanced Fluid Mechanics
GEOL 0810 Planetary Geology
GEOL 1710 Remote Sensing of Earth and Planetary Surfaces
GEOL 1810 Physics of Planetary Evolution
MATH 1060 Differential Geometry
PHYS 0500 Advanced Classical Mechanics
PHYS 0560 Experiments in Modern Physics
PHYS 1410 Quantum Mechanics A
PHYS 1510 Advanced Electromagnetic Theory
PHYS 1530 Thermodynamics and Statistical Mechanics
PHYS 1560 Modern Physics Laboratory
PHYS 1600 Computational Physics

Total Credits 11-12

1 PHY 0050 and PHYS 0060 can be taken in lieu of PHYS 0160
PHYS 0030. Basic Physics.
Survey of mechanics for concentrators in sciences other than physics—
including premedical students or students without prior exposure to
physics who require a less rigorous course than PHYS 0050, 0060.
Employ the concepts of elementary calculus but little of its technique.
Lectures, conferences, and laboratory. Six hours of attendance.
Recommended: MATH 0090 or 0100.

PHYS 0040. Basic Physics.
Survey of electricity, magnetism, optics, and modern physics for
concentrators in sciences other than physics—premedical
students or students without prior exposure to physics who require a
less rigorous course than PHYS 0050, 0060. Employ the concepts of
elementary calculus but little of its technique. Lectures, conferences, and
laboratory. Recommended: MATH 0090 or 0100.

An introduction to Newtonian mechanics that employs elementary
calculus. Intended for science concentrators. Potential physics
concentrators who do not have adequate preparation for PHYS 0070,
may enroll, but are urged to continue with PHYS 0100 rather than PHYS
0050. Lectures, conferences and laboratory. Six hours of attendance.
Recommended: MATH 0090 or MATH 0100.

An introduction to the principles and phenomena of electricity, magnetism,
optics, and the concepts of modern physics. Recommended for those
who wish to limit their college physics to two semesters but seek a firm
grounding in the subject, including but not limited to those with some
previous knowledge of physics. Lectures, conferences, and laboratory. Six
hours of attendance. Prerequisite: PHYS 0050. Recommended: MATH
0100.

A mathematically rigorous introduction to Newtonian mechanics than
PHYS 0050. For first-year students and sophomores who have studied
physics previously and have completed a year of calculus. Lectures,
conferences, and laboratory. Six hours of attendance. Prerequisites: high
school physics and calculus or written permission.

PHYS 0100. Flat Earth to Quantum Uncertainty: On the Nature
and Meaning of Scientific Explanation.
This new course aims at freshmen with good preparation in high school
physics, chemistry and biology, but who have not had a solid
idea of what specific disciplines to focus on in their college study at Brown. The course
will introduce important physics concepts and techniques relevant to
biology and medicine, such as diffusion and transport of molecules
and intracellular components, Brown motion and advection of
microbes, motion of particles confined by a harmonic potential, Boltzmann
distribution, exponential growth or decay, and statistics of single molecule
behave. The goal of the course is to cultivate interest and provide
essential basics for more rigorous study of biological physics as a branch
of interdisciplinary science. Enrollment limited to 20 first-year students. Instructor permission required. FYS WRIT

PHYS 0110. Excursion to Biophysics.
An introduction to modern cosmology for nonphysicists. Topics include:
the nature of space and time, the expanding universe, black holes, and
the quantum nature of the universe in the attempt to bridge the gap
between sciences and humanities. No mathematics other than high school algebra
is assumed. Willingness to be challenged by bold new ideas and an
inquisitive mind are prerequisites.

PHYS 0111. Are There Extra Dimensions Under Your Bed?
Discusses some of the most exciting questions confronting contemporary
physics in fashion suitable for both humanists and scientists. What are particles, antiparticles, superstrings, and black holes? How
are space and time related? How are mass and gravity related to space
and time? Do we live in a three-dimensional world, or are there extra
dimensions? The seminar will address such questions with conceptual
explanations based upon current research on campus, and highlight
the experiments at the energy frontier, being carried out by the world's largest
scientific instrument to-date, the Large Hadron Collider, located in Geneva,
Switzerland. Enrollment limited to 20 first-year students. FYS WRIT

PHYS 0112. Allen Worlds: The Search for Extra-Solar Planets
and Extraterrestrial Life.
The course will cover the significant developments in the detection
and characterization of extra-solar planetary systems in the past 20 years. We
will study the astrophysics of planetary system formation, the techniques
for detecting planets, the properties of the planets discovered so far, and
the prospects for future discoveries, with an emphasis on the search for
"Earth-analogues" and the implications for astrobiology. Enrollment limited
to 20 first-year students. FYS

PHYS 0113. Squishy Physics.
A freshman seminar to explore everyday applications of physics. It offers
practical training on project based learning. The course involves hands-on
experimentation, data analysis and presentation. The course is designed
for students interested in any field of science with no pre-requisite. The
topics covered include motion, forces, flow, elasticity, polymers, gels,
electricity, energy, etc. Students will be guided to work on several projects
over the semester. They are required to report their projects in both written
and oral reports. There is no exam for the course. Students are required to
register for one of the labs. FYS

PHYS 0114. The Science and Technology of Energy.
Energy plays fundamental roles in society. Its use underlies improvements in
the living standard; the consequences of its use have a significant impact on the Earth's climate; its scarcity in certain forms is a source of
insecurity and political conflict. This course will introduce the fundamental
laws that govern energy and its use. Physical concepts to be covered:
mechanical energy, thermodynamics, the Carnot cycle, electrically and
magnetically, quantum mechanics, and nuclear physics. Technical applications include wind, hydro, and geothermal energy, engines
and fuels, electrical energy transmission and storage, solar energy and
photovoltaics, nuclear reactors, and biomass. Enrollment limited 20. FYS

PHYS 0120. Adventures in Nanoworld.
Richard Feynman famously said, "There's plenty of room at the bottom,"
about the possibility of building molecular-size machines operating
garment above Quantum Mechanics. Scientists are now learning the art, and
students in this course will use basic physics and simple mathematical
models to understand the phenomena and materials in the nanoworld.
Non-science concentrators and potential science concentrators alike will
learn about important classes of nanomaterials including at least:
semiconductors, quantum dots, quantum wires, and films. We will learn
how people make nanomaterials and characterize them. We will consider
existing and potential applications of nanotechnology, including molecular
machines, nanoelectronics, spintronics, and quantum information. Enrollment
limited to 20 first-year students. FYS WRIT

PHYS 0121. Introduction to Environmental Physics: The Quantum
Mechanics of Global Warming.
We will use basic physics and simple mathematical models to investigate
current climate change, energy and entropy, the dispersal of pollutants, solar
power, and other aspects of environmental science. Lectures will be
supplemented with demonstrations of key physical principles. Emphasis
will be placed on quantitative reasoning.

PHYS 0150. Brief History of Time.
An introduction to modern cosmology for nonphysicists. Topics include:
the nature of space and time, the expanding universe, black holes, and
the origin of structure in the universe. Attempts to bridge the gap between
sciences and humanities. No mathematics other than high school algebra
is assumed. Willingness to be challenged by bold new ideas and an
inquisitive mind are prerequisites.

PHYS 0160. Introduction to Relativity and Quantum Physics.
A mathematically rigorous introduction to special relativity and quantum
mechanics. The second course in the three-semester sequence (PHYS
0470 being the third) for those seeking the strongest foundation in physics.
Also suitable for students better served by an introduction to modern
physics rather than electromagnetism. Lectures, conferences, and
laboratory. Six hours of attendance. Prerequisite: PHYS 0070 or 0050. Recommended: MATH 0180 or 0200.

PHYS 0180. Physics for Non-Physicists: An Introduction to Classical and Modern Physics. This course is an introduction to many major concepts in physics. It is intended for a general audience, and calculus is not required. Along the way, we will address the question "what goes into making a scientific theory?" using the works of Euclid, Galileo, Newton and others as examples. Concepts range historically from planetary motion (addressed at least as early as Ancient Greece) to modern physics topics that are still under debate today. These concepts include (but are not limited to) motion, forces, energy, electricity and magnetism, special relativity and quantum mechanics.

PHYS 0210. Beginning Astronomy. Semester I: historical and conceptual developments and the study of the solar system. Semester II: stars and their evolution, our galaxy, and the universe at large. Considers the role of pulsars, quasars, neutron stars, and black holes in modern views of the universe. Three hours of attendance. See also PHYS 0270. Either semester may be taken independently.

PHYS 0220. Astronomy. An introduction to basic ideas and observations in astronomy, starting with the observed sky, coordinates and astronomical calendars and cycles, the historical development of our understanding of astronomical objects. Particular emphasis is placed on the properties of stars, galaxies, and the Universe as a whole, including the basic ideas of cosmology. The material is covered at a more basic level than PHYS 0270. Knowledge of basic algebra and trigonometry is required, but no experience with calculus is necessary. The course includes evening laboratory sessions.

PHYS 0270. Introduction to Astronomy. A complete survey of basic astronomy, more rigorous than is offered in PHYS 0220. Requires competence in algebra, geometry, trigonometry, and vectors and also some understanding of calculus and classical mechanics. Laboratory work required. This course or an equivalent required for students concentrating in astronomy. The course includes conferences and evening laboratory sessions.

PHYS 0280. Introduction to Astrophysics and Cosmology. A survey of astrophysical phenomenology and the application of physical theory to its interpretation. Prerequisites: PHYS 0040, 0060, 0180 or written permission.

PHYS 0470. Electricity and Magnetism. Electric and magnetic fields. Motion of charged particles in fields. Electric and magnetic properties of matter. Direct and alternating currents. Maxwell's equations. Laboratory work. Prerequisites: PHYS 0040, 0060, or 0180; and MATH 0180, 0200 or 0350. Labs meet every other week.

PHYS 0500. Advanced Classical Mechanics. Dynamics of particles, rigid bodies, and elastic continua. Normal modes. Lagrangian and Hamiltonian formulations. Prerequisites: PHYS 0070, 0180 or 0050, 0060 and MATH 0180 or 0200; or approved equivalents.

PHYS 0560. Experiments in Modern Physics. Introduction to experimental physics. Students perform fundamental experiments in modern quantum physics, including atomic physics, nuclear and particle physics, and condensed matter physics. Visits to research labs at Brown acquaint students with fields of current research. Emphasizes laboratory techniques, statistics, and data analysis. Three lecture/discussion hours and three laboratory hours each week. Required of all physics concentrators. Prerequisites: PHYS 0070, 0160 or 0050, 0060; 0470. WRIT

PHYS 0720. Methods of Mathematical Physics. This course is designed for sophomores in physical sciences, especially those intending to take sophomore or higher level Physics courses. Topics include linear algebra (including linear vector spaces), Fourier analysis, ordinary and partial differential equations, complex analysis (including contour integration). Pre-requisites: PHYS 0060 or 0160, MATH 0180, 0200 or 0350, or consent of the instructor.

PHYS 0790. Physics of Matter. An introduction to the principles of quantum mechanics and their use in the description of the electronic, thermal, and optical properties of materials. Primarily intended as an advanced science course in the engineering curriculum. Open to others by permission. Prerequisites: ENGN 0040, APMA 0340 or equivalents.

PHYS 1100. Introduction to General Relativity. An introduction to Einstein's theory of gravity, including special relativity, spacetime curvature, cosmology and black holes. Prerequisites: PHYS 0500 and MATH 0620 or MATH 0540 or equivalent, or permission of the instructor. Recommended: PHYS 0720. Offered every other year.

PHYS 1170. Introduction to Nuclear and High Energy Physics. A study of modern nuclear and particle physics, with emphasis on the theory and interpretation of experimental results. Prerequisites: PHYS 1410, 1420 (may be taken concurrently), or instructor permission.

PHYS 1250. Stellar Structure and the Interstellar Medium. This class is an introduction to the physics of stars and their environment. The course covers the fundamental physics that set the physical properties of stars, such as their luminosity, size, spectral properties and how these quantities evolve with time. In addition, it includes a study of the physics that takes place in the gaseous environment surrounding stars, the Interstellar Medium (ISM). The ISM is very important because it contains a wealth of information on the evolutionary history of galaxies, their composition, formation and future. Prerequisites: PHYS 0270, PHYS 0500, or PHYS 1530 (perhaps taken concurrently) is strongly recommended but not required.

PHYS 1270. Extragalactic Astronomy and High-Energy Astrophysics. This course provides an introduction to the astrophysics of galaxies, their structure and evolution, with an emphasis on physical introduction of the observations. Underlying physics concepts such as radiative transfer, nuclear reactions and accretion will be introduced. Intended for students at the junior level. Prerequisites: PHYS 0270 and PHYS 0470, and either MATH 0190 or MATH 0200, or instructor permission. WRIT

PHYS 1280. Introduction to Cosmology. The course presents an introduction to the study of the origin, evolution, and contents of the Universe. Topics include the expansion of the Universe, relativistic cosmologies, thermal evolution, primordial nucleosynthesis, structure formation and the Cosmic Microwave Background. Prerequisites: PHYS 0160, MATH 0190, MATH 0200, or MATH 0350, or instructor permission.

PHYS 1410. Quantum Mechanics A. A unified treatment of quanta, photons, electrons, atoms, molecules, matter, nuclei, and particles. Quantum mechanics developed at the start and used to link and explain both the older and newer experimental phenomena of modern physics. Prerequisites: PHYS 0500 and 0560, and MATH 0520, 0540 or PHYS 0720, or approved equivalents.

PHYS 1420. Quantum Mechanics B. See Quantum Mechanics A, (PHYS 1410) for course description.

PHYS 1510. Advanced Electromagnetic Theory. Maxwell's laws and electromagnetic theory. Electromagnetic waves and radiation. Special relativity. Prerequisites: PHYS 0470, and MATH 0180, 0200, or 0350; or approved equivalents.

PHYS 1530. Thermodynamics and Statistical Mechanics. The laws of thermodynamics and heat transfer. Atomic interpretation in terms of kinetic theory and elementary statistical mechanics. Applications to physical problems. Prerequisites: MATH 0180 or 0200 or 0350. Corequisite: PHYS 1410.

PHYS 1560. Modern Physics Laboratory. A sequence of intensive, advanced experiments often introducing sophisticated techniques. Prerequisites: PHYS 0470, 0500 and 0560; and MATH 0520, 0540 or PHYS 0720; or approved equivalents. WRIT

PHYS 1600. Computational Physics. This course provides students with an introduction to scientific computation, primarily as applied to physical science problems. It will assume a basic knowledge of programming and will focus on how computational methods can be used to study physical systems complementing experimental and theoretical techniques. Prerequisites:
PHYS 0070, 0160 (or 0050, 0060) and 0470 (or ENGN 0510); MATH 0180 or 0200 or 0350; the ability to write a simple computer program in Fortran, Matlab, C or C++. WRIT

PHYS 1610. Biological Physics.
Introduction on structures of proteins, nucleotides, and membranes; electrophysics and hydration; chemical equilibrium; binding affinity and kinetics; hydrodynamics and transport; cellular mechanics and motions; biophysical techniques including sedimentation, electrophoresis, microscopy and spectroscopy. Suitable for undergraduate science and engineering majors and graduate students with limited background in life science. Prerequisites: MATH 0180.

PHYS 1970A. Stellar Physics and the Interstellar Medium.
No description available.

PHYS 1970B. Topics in Optics.
Introduction to optical principles and techniques. Offered to students who have a foundation in physics and are especially interested in optics. The course covers the interaction of light with matter, geometric and wave optics, polarization, fluorescence, and optical instruments (e.g. interferometer, spectrometer, microscope and telescope). Recommended are one physics course (PHYS 0040, PHYS 0060, or ENGR 0040) and one calculus course (MATH 0180, MATH 0200, or MATH 0350), or per instructor's permission.

This course will concentrate on String Theory. It will be given at introductory/intermediate level with some review of the background material. Topics covered will include dynamical systems, symmetries and Noether's Theorem; nonrelativistic strings; relativistic systems (particle and string); quantization, gauge fixing, Feynman's sum over paths; electrostatic analogy; string in curved space-time; and supersymmetry. Some advanced topics will also be addressed, i.e., D-Branes and M-Theory. Recommended prerequisites: PHYS 0470 and 0500, or 0160.

PHYS 1970F. Quantum Information.
Quantum information is the modern study of how to encode and transmit information on the quantum scale—in many ways fundamentally different from classical information. This course will connect a standard treatment of Quantum mechanics with information theory. Some topics will overlap with phys 1410, but information will be presented from a different viewpoint and with new applications. Topics covered will include: measurement, quantum states, bits, density of states, entanglement, quantum information processing, computing, and some special topics. Students will be expected to complete an end of term project for successful completion of the course.

Designed for undergraduates to participate, individually or in small groups, in research projects mentored by the physics faculty. Students must have taken one year of college level physics. An average of 8 to 10 hours per week of guided research is required as are weekly meetings with the supervising faculty member. Students should consult with faculty to find a mutually agreeable research project and obtain permission to enroll. Section number varies by instructor (students must register for the appropriate section).

PHYS 1990. Senior Conference Course.
Preparation of thesis project. Required of candidates for the degree of bachelor of science with a concentration in physics. Section numbers vary by instructor. Please check Banner for the correct section number and CRN to use when registering for this course.

PHYS 2010. Techniques in Experimental Physics.
No description available.

An introduction to methods of mathematical analysis in physical science and engineering. The first semester course includes linear algebra and tensor analysis; analytic functions of a complex variable; integration in the complex plane; potential theory. The second semester course includes probability theory; eigenvalue problems; calculus of variations and extremum principles; wave propagation; other partial differential equations of evolution.

PHYS 2030. Classical Theoretical Physics I.
No description available.

PHYS 2040. Classical Theoretical Physics II.
No description available.

PHYS 2050. Quantum Mechanics.
No description available.

PHYS 2060. Quantum Mechanics.
No description available.

PHYS 2070. Advanced Quantum Mechanics.
No description available.

PHYS 2100. General Relativity and Cosmology.
Given every other year.

PHYS 2140. Statistical Mechanics.
No description available.

PHYS 2170. Introduction to Nuclear and High Energy Physics.
No description available.

PHYS 2200. Elementary Particle Physics I.
Alternates with PHYS 2210.

PHYS 2210. Elementary Particle Physics II.
No description available.

PHYS 2280. Astrophysics and Cosmology.
This course serves as a graduate-level introduction to modern cosmology, including current topics of research on both observational and theoretical fronts. Topics include relativistic cosmology, inflation and the early Universe, observational cosmology, galaxy formation. Prerequisites for undergraduates: PHYS 1280 and PHYS 1530.

PHYS 2300. Quantum Theory of Fields I.
No description available.

PHYS 2320. Quantum Theory of Fields II.
No description available. Instructor permission required.

PHYS 2340. Group Theory.
Offered every other year.

PHYS 2410. Solid State Physics I.
No description available.

PHYS 2420. Solid State Physics II.
No description available.

PHYS 2430. Quantum Many Body Theory.
No description available.

PHYS 2450. Exchange Scholar Program.

PHYS 2470. Advanced Statistical Mechanics.
No description available.

PHYS 2600. Computational Physics.
This course provides students with an introduction to scientific computation at the graduate level, primarily as applied to physical science problems. It will assume a basic knowledge of programming and will focus on how computational methods can be used to study physical systems complementing experimental and theoretical techniques. Prerequisites: PHYS 2030, 2050, 2140; the ability to write a simple computer program in Fortran, Matlab, C or C++.

PHYS 2610A. Selected Topics in Modern Cosmology.
Aims to provide a working knowledge of some main topics in modern cosmology. Combines study of the basics with applications to current research.

PHYS 2610B. Theory of Relativity.
No description available.

PHYS 2610C. Selected Topics in Condensed Matter Physics.

PHYS 2610D. Selected Topics in Condensed Matter Physics.
The objective of this course is to introduce recent development in condensed matter physics. Selected topics include: nanoscale physics, materials, and devices; spintronics and magnetism; high temperature superconductivity; strongly correlated systems; Bose-Einstein condensate;
and applications of condensed matter physics. In addition to discussing physics, some experimental techniques used in current research will also be introduced. The course will help students broaden their scope of knowledge in condensed matter physics, learn how to leverage their existing background to select and conduct research, and develop a sense of how to build their professional career based on condensed matter physics.

PHYS 2610E. Selected Topics in Physics of Locomotion. This special topics graduate course deals with the physical processes involved in the locomotion of organisms, with a particular focus on locomotion at small scales in fluids. Topics include mechanisms of swimming motility for microorganisms, fluid mechanics at low Reynolds number, diffusion and Brownian motion, physical actuation, hydrodynamic interactions, swimming in complex fluids, artificial swimmers, and optimization. Prerequisites: (PHYS 0470 or ENGN 0510) and (PHYS 0500 or ENGN 0810 or ENGN 1370), or permission of the instructor.

PHYS 2610F. Selected Topics in Collider Physics. The course will cover basic aspects of conducting precision measurements and searches for new physics at modern high-energy colliders, with the emphasis given to physics at the Large Hadron Collider. The course will cover major aspects of conducting physics analysis from the underlying theory to experimental methods, such as optimization of the analysis, multivariate analysis techniques, use of statistical methods to establish a signal or set the limit. There will be reading assignments, in-class student presentations, and hands-on exercises offered as the part of the course. Prerequisite: PHYS 1170 or 2170. Open to graduate students in Physics and Math.

PHYS 2610G. Special Topics in Particle Physics: The Standard Model and Beyond. This course will explain the theoretical basics of the Standard Model and some of the experimental evidence that has established it. Among other things, students completing the course will understand how recent data from the Large Hadron Collider has established the existence of the Higgs boson, as well as the theoretical implications of this discovery, which we will use to synthesize many ideas learned in the course. The course will also discuss some candidate theories beyond the Standard Model such as supersymmetry and dark matter models.

PHYS 2620A.Astrophysical and Cosmological Constraints on Particle Physics. No description available.

PHYS 2620B. Green's Functions and Ordered Exponentials. No description available.

PHYS 2620C. Introduction to String Theory. No description available.

PHYS 2620D. Modern Cosmology. No description available.

PHYS 2620E. Selected Topics in Quantum Mechanics: Fuzzy Physics. No description available.

PHYS 2620F. Selected Topics in Molecular Biophysics. No description available.

PHYS 2620G. The Standard Model and Beyond. Topics to be covered will include: Yang-Mills theory, origin of masses and couplings of particles, effective field theory, renormalization, confinement, lattice gauge theory, anomalies and instantons, grand unification, magnetic monopoles, technicolor, introduction to supersymmetry, supersymmetry breaking, the Minimal Supersymmetric Standard Model, and dark matter candidates. Prerequisite: Phys 2300.

PHYS 2630. Biological Physics. The course is the graduate version of Phys 1610, Biological Physics. The topics to be covered include structure of cells and biological molecules, diffusion, dissipation and random motion; flow and friction in fluids; entropy, temperature and energy; chemical reactions and self-assembly; solution electrostatics; action potential and nerve impulses. The graduate level course has additional pre-requisites of Phys 0470 and 1530, or equivalents. It requires homework assignments at the graduate level. The final grades will be assigned separately from those who take the course as Phys 1610, although the two groups may be taught in the same classroom.

PHYS 2710. Seminar in Research Topics. Instruction via reading assignments and seminars for graduate students on research projects. Credit may vary. Section numbers vary by instructor. Please check Banner for the correct section number and CRN to use when registering for this course.

PHYS 2711. Seminar in Research Topics. See Seminar In Research Topics (PHYS 2710) for course description. Section numbers vary by instructor. Please check Banner for the correct section number and CRN to use when registering for this course.

PHYS 2970. Preliminary Examination Preparation. For graduate students who have met the tuition requirement and are paying the registration fee to continue active enrollment while preparing for a preliminary examination.

PHYS 2980. Research in Physics. Section numbers vary by instructor. Please check Banner for the correct section number and CRN to use when registering for this course.

PHYS 2981. Research in Physics. Section numbers vary by instructor. Please check Banner for the correct section number and CRN to use when registering for this course.

PHYS 2990. Thesis Preparation. For graduate students who have met the tuition requirement and are paying the registration fee to continue active enrollment while preparing a thesis.

Political Science

Chair

Wendy J. Schiller

Traditionally, political science splits into four subfields: (1) the study of politics in the United States (American politics); (2) the comparative study of different political systems and individual nations around the globe (comparative politics); (3) the study of relations among states and peoples (international relations); and (4) the philosophical study of political ideas (political theory). What particularly moves us at Brown are the big questions about political life—both at home and around the world. We engage these questions in a wide range of different political contexts, often in ways that cross between the traditional subfields. We also pay particular attention to how our analyses touch the real world of people and politics.

You'll find us involved all around the campus: at the A. Alfred Taubman Center for American Politics and Policy, the Watson Institute for International and Public Affairs, the Political Theory Project, Development Studies, India Initiative, Middle East Studies, China Initiative, Center for Latin American and Caribbean Studies, Pembroke Center, Cogut Center for the Humanities among many others.

For additional information, please visit the department's website: http://www.brown.edu/Departments/Political_Science/

Political Science Concentration Requirements

Why do Hindus and Muslims live in harmony in one city and fight bitterly in another just a few miles away? Why is the U.S. the only industrialized nation without a complete national health insurance? What is the legacy of slavery in the U.S.? Why are there so few women in Congress? How is radicalism in the Middle East changing? Why and how does democracy flourish? Just what is democracy? How do emotions shape our political behavior? What do war movies tell us about the USA? Would less government lead to more social justice? What is social justice? How does smuggling (of drugs, guns, and people) reshape international relations? How do immigrants see the American Dream? What is the American dream?

Political science is about questions like these. You can grapple with every one of them—and many more—in the classrooms of the Brown political science department. We study how people—nations, regions, cities,
Avkhadiev, Artur
“Treading Geodesic Pathways through the Configuration Space of a Linear Polymer”
Advisor: Professor Stratt (Chemistry)

Butler, Jack
“Mapping Dark Matter in the Galaxy Clusters of the Northern Hemisphere”
Advisor: Professor Dell’Antonio

Canaras, Zoe
“Constraining Sensitivity to the EoR Power Spectrum”
Advisor: Professor Pober

Cheng, Rebecca
“Studying and characterizing potential scale dependence of the sheet resistance of thin silver films”
Advisor: Professor Valles

Coleman, Evan
“Maximal Chaos in Black Holes”
Advisor: Professor Jevicki

Dallas, Emanuel
“2D BEC”
Advisor: Professor Kosterlitz

Dick, Nathaniel
“Exploring the Inhomogeneous Distribution of Matter Due to Perturbations in the Early Universe”
Advisor: Professor Koushiappas

Dudak, Matthew
“Incorporating Computation in Introductory High School Physics”
Advisor: Professor Targan & Professor Silva-Pimentel (Education)

Greer, Cory
“A search for dwarf candidates in wide-field surveys”
Advisor: Professor Dell’Antonio

Hartig, Kara
Advisor: Professor Marston

Herrera, Kairy
“Investigations on Superfluid Dark Matter”
Advisor: Professor Alexander

Hirsch, Alexander
“A Python Environment for Wide-angle Energy-momentum Spectroscopy Analysis”
Advisor: Professor Zia (Engineering)

Isik, Oliver
“Detecting John Cunningham Virus Translocations through Solid-State Nanopores”
Advisor: Professor Stein

Kang, Lucas
“Adinkras From Ordered Quartets of BC4 Coxeter Group Elements and Regarding Another Gadget’s 1,358,954,496 Matrix Elements.”
Advisor: Professor Gates

Ortega, Marlene
“Methods for the distinction of hadronically decaying boosted W±/Z bosons”
Advisor: Professor Narain

Marmor, Andrew
“Dynamical Friction...black holes “
Advisor: Professor Koushiappas

*Please note that honors with links are available on our website at https://www.brown.edu/academics/physics/honors-senior-theses
Miller, Michelle
“Recovering the Physics of the Epoch of Reionization using Semi-Analytic 21CMMC Code”
Advisor: Professor Pober

Quigley, Keegan
“Physical Amplification of Chemical Colorimetric Sensing and a Transfer Matrix Analysis”
Advisor: Professor Xu (Engineering)

Sridhar Narayanan, Adarsh
“Using Machine Learning to Variationally Optimize Fermionic Wave Functions”
Advisor: Professor Rubinstein (Chemistry)

Stern, Nicholas
“Dark Matter Directionality: Effect of Nuclear Recoil Direction Relative to Applied Electric Field on Ionization Yield in the LUX Detector”
Advisor: Professor Gaitskell

Storer, Dara
“Analysis of the Best-Fit Sky Model Produced Through Redundant Calibration of the MWA”
Advisor: Professor Pober

Tan, Matthew
“Linearity of the Hamamatsu R11410 Photomultiplier Tube in cryogenic temperatures for the LUX-ZEPLIN experiment”
Advisor: Professor Gaitskell

Yaruss, Emily
“Determining Dark Matter Distribution Through Gravitational Lensing in Low-Redshift Galaxy Clusters in the Southern Hemisphere”
Advisor: Professor Dell'Antonio

*Please note that honors with links are available on our website at https://www.brown.edu/academics/physics/honors-senior-theses