Physics and Philosophy

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 many higher-level physics courses and which relies in turn on PHYS 0160 or PHYS 0060. 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 0060 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:
   PHIL 0210 Science, Perception and Reality
   PHIL 0100 Critical Reasoning
   PHIL 0060 Modern Science and Human Values
   PHIL 0540 Logic
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 1590 Philosophy of Science
   PHIL 1620 Philosophy of Quantum Mechanics
   PHIL 1660 Metaphysics
   PHIL 1670 Time
   PHIL 1750 Epistemology

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: 1
   MATH 0180 Intermediate Calculus
   MATH 0200 Intermediate Calculus (Physics/Engineering)
   MATH 0350 Honors Calculus

Final Project
Select one of the following: 1
   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.