

Department of

Physics

**Stephen Turcotte, Department Chair**

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Introduction

“The most incomprehensible thing about the universe is that it is comprehensible.” - Albert Einstein

Physics is devoted to the study of matter and energy on a range of scales extending from the size of the atom to the size of the entire universe. Advances in our understanding of matter and its interactions have led to great scientific and technological progress. This progress will continue in the future as physicists refine their tools and techniques of inquiry.

A background in Physics opens up a wide variety of career opportunities. Solid state physicists are involved in the semiconductor industry and the development of a wide range of materials such as superconductors, ceramics, and conducting polymers. Nuclear physicists are in high demand in nuclear medicine, now used extensively for diagnosis and treatment. The nuclear energy industry is poised to experience rapid growth in the next few years. A background in optics can be applied in fiber optic communication and the design of optical instruments for astronomy and the aerospace industry. In addition, physics is applied in a variety of scientific and engineering fields including astronomy, biology, geology, and acoustics.

Physicists have the scientific and technological versatility that allows them to work in a wide range of levels and disciplines. In recent years, physicists have been utilized in areas outside of science and The Bachelor of Science (B.S.) degree in physics at BYU–Idaho offers students a solid foundation in both classical and modern physics. Students take a range of introductory and advanced classes in mechanics, electricity and magnetism, quantum mechanics, and thermal

physics. In addition, the laboratory courses give students valuable skills and knowledge in experimental physics, extensive experience in modeling and simulations, computer control of devices and data acquisition.

In addition to the knowledge that students gain in the physics program at BYU–Idaho, students develop a comprehensive set of valuable skills that can be applied to many career paths. These skills include (but are not limited to) critical thinking, reading, and writing skills, mathematical and conceptual reasoning, computer skills, leadership and communication skills, problem solving, creativity, synthesizing results and applying theory to real world problems.

After completing their B.S. in physics from BYU–Idaho, students will have a wide range of opportunities. These include the following:

- Graduate school: students can continue their studies in physics or a number of other disciplines
- Professional school: students can go on to medical school, dental school, business school or law school
- Industry: Physicists are hired by a number of companies and government labs throughout the country

The Bachelor of Science in Physics Education at BYU–Idaho prepares students to teach physics in high school. Each Physics Education major must complete the Secondary Education Core and carefully select an approved education minor. Please discuss your choice of an Education minor with your advisor.

Supported Tracks

The physics department supports all three tracks (FW, WS, SF) during the freshman and sophomore years. Before the junior year, a student will need to switch to the FW track.

Technical Industrial Science Majors

These majors take a two semester Introductory Applied Physics course (PH 105 and 106, which includes a lab component). These courses require extensive use of Algebra and Trigonometry. CHECK WITH ADVISOR TO ENSURE THAT YOU ARE ENROLLED IN THE CORRECT COURSE.

Life Science/ Pre-Medicine, Architecture Majors

These majors take a two semester Pre-Medical Professional Physics course (PH 115 and PH 116, which includes a lab component). These courses require extensive use of Algebra and Trigonometry. CHECK WITH ADVISOR TO ENSURE THAT YOU ARE ENROLLED IN THE CORRECT COURSE.

Physics/Chemistry/Engineering/Mathematics/Computer Science Majors

These majors take one to four calculus based Principles of Physics courses (Ph 121, 123, 220, 279), and two one-semester labs (Ph 150 & Ph 250). CHECK WITH YOUR ADVISOR TO ENSURE THAT YOU ARE ENROLLED IN THE CORRECT COURSE.

Physics

Brigham Young University-Idaho 2009-2010

BS in Physics (770)

Take required Foundations courses

Major Requirements

No Double Counting of Major Courses - No Grade Less Than C- in Major Courses

<i>Take these courses:</i>		<i>Take 1 courses:</i>	
MATH 215	4	PH 323	3
MATH 316	4	PH 324	3
PH 121	3	PH 374	3
PH 123	3	PH 375	<u>3</u>
PH 150	1		3
PH 220	3		
PH 250	1	<i>Take 1 course:</i>	
PH 279	3	PH 398R	1-3
PH 291	2	PH 406	<u>1</u>
PH 314	3		1
PH 328	2		
PH 332	4		
PH 333	4		
PH 336	2		
PH 372	3		
PH 405	2		
PH 433	3		
PH 473	3		
PH 488	<u>1</u>		
	51		

Program Notes:

Total Major Credits=55

This major also requires a minor or 2 clusters

This major is available on the following tracks:

Fall-Winter---- YES

Winter-Spring/Spring-Fall----

Freshman Sophomore YES/Junior Senior NO

BS in Physics Education (870)

Take required Foundations courses

Major Requirements

No Double Counting of Major Courses - No Grade Less Than C- in Major Courses

Education Core		<i>Take these courses:</i>	
<i>Take these courses:</i>		FDMAT 112	4
ED 200	2	MATH 113	3
ED 304	3	PH 121	3
ED 361	3	PH 123	3
ED 461	3	PH 127	4
ED 492	10	PH 150	1
SPED 360	<u>2</u>	PH 220	3
	23	PH 250	1
		PH 279	3
		PH 311	3
		PH 314	3
		PH 403	3
		PH 411	<u>3</u>
			37

Program Notes:

Total Major Credits=37

Total Education Core Credits=23

This major is available on the following tracks:

Fall-Winter---- YES

Winter-Spring---- NO

Spring-Fall---- YES

Minor in Physics (104)

Minor Requirements

No Double Counting of Minor Courses

<i>Take these courses:</i>	
MATH 215	4
PH 121	3
PH 123	3
PH 150	1
PH 220	3
PH 250	1
PH 279	3
PH 311	3
PH 314	3
	24

Program Notes:

Total Minor Credits=24

This minor is available on the following tracks:

Fall-Winter---- YES

Winter-Spring---- YES

Spring-Fall---- YES

Minor in Physics Education (178)

Minor Requirements

No Double Counting of Minor Courses

<i>Take these courses:</i>	
PH 121	3
PH 123	3
PH 150	1
PH 220	3
PH 250	1
PH 279	3
PH 311	3
PH 314	3
	20

Program Notes:

Total Minor Credits=20

This minor is available on the following tracks:

Fall-Winter---- YES

Winter-Spring---- YES

Spring-Fall---- YES

Minor in Physical Science Education (182)

Minor Requirements

No Double Counting of Minor Courses

<i>Take these courses:</i>		<i>Take 1 course:</i>		<i>Take these courses:</i>	
CHEM 105	4	CHEM 150	5	PH 105	4
CHEM 106	4	CHEM 220	5	PH 106	4
	8	CHEM 351	4		8
			4	OR	
				<i>Take these courses:</i>	
				PH 115	4
				PH 116	4
					8

Program Notes:

Total Minor Credits=20

This minor is available on the following tracks:

Fall-Winter---- YES

Winter-Spring---- YES

Spring-Fall---- YES

Physics

Brigham Young University-Idaho 2009-2010

Physics Pre-approved Clusters

Technical Physics

Take 12 Credits:

PH 121	Principles of Physics I	3
PH 123	Principles of Physics II	3
PH 150	Beginning Physics Lab	1
PH 220	Principles of Physics III	3
PH 250	Intermediate Physics Laboratory for Physics and Physical Science	1
PH 279	Modern Physics	3
PH 311	Physics by Inquiry I	3
PH 314	History/Philosophy of Science	<u>3</u>
	Total Credits	12

Physics Exposure

Take either

PH 105	Introductory Applied Physics I	4
PH 106	Introductory Applied Physics II	4
OR		
PH 115	Pre-Med Professional Physics I	4
PH 116	Pre-Med Professional Physics II	4
AND		
PH 311	Physics by Inquiry I	3
PH 314	History/Philosophy of Science	<u>3</u>
	Total Credits	14

Physical Science Pre-approved Clusters

Technical Physics

Take 12 credits:

PH 121	Principles of Physics I	3
PH 123	Principles of Physics II	3
PH 150	Beginning Physics Lab	1
PH 220	Principles of Physics III	3
PH 250	Intermediate Physics Lab	1
PH 279	Modern Physics	3
PH 311	Physics by Inquiry I	3
PH 314	History/Philosophy of Science	<u>3</u>
	Total Credits	12

Physics Exposure

Take either:

PH 105	Introductory Applied Physics I	4
PH 106	Introductory Applied Physics II	4
OR		
PH 115	Pre-Medical Professional Physics I	4
PH 116	Pre-Medical Professional Physics II	4
AND		
PH 311	Physics by Inquiry I	3
PH 314	History/Philosophy of Science	<u>3</u>
	Total Credits	14

Physical Science and Mathematics

Take 12 credits from at least 2 of the following areas:

Chemistry

CHEM 105	General Chemistry	4
CHEM 106	General Chemistry	4

Physics

PH 105	Introductory Applied Physics I	4
PH 106	Introductory Applied Physics I	4
OR		
PH 115	Pre-Med Professional Physics I	4
PH 116	Pre-Med Professional Physics II	4
OR		
PH 121	Principles of Physics I	3
PH 123	Principles of Physics II	3
PH 220	Principles of Physics III	3

Course Descriptions	Credits*	
<p>PH 101 Fundamentals of Physics (4.0:3:3)</p> <p>Prerequisite: Competency with high school algebra is assumed</p> <p>Principles of classical and modern physics as they relate to current concepts of the physical environment. This course includes a three hour lab.</p> <p>(Fall, Winter (alternating))</p>		<p>PH 123 Principles of Physics II (3.0:2:3)</p> <p>Prerequisite: PH 121 or ME 204, concurrent registration or completion of Math 113 or Math 215.</p> <p>This course is the second semester of the Principles of Physics sequence. The course is designed for students majoring in physics, engineering, chemistry and mathematics. The course covers topics in waves, thermodynamics, and optics. These areas of study are important in a wide variety of engineering and scientific disciplines. For example, an understanding of wave properties is essential in various electrical engineering applications such as wireless communication as well as all aspects of acoustics. Thermodynamics has a variety of applications in engine design and heat transfer. Finally, principles of optics are involved in fiber-optic communication, instrument design, scanners, surveillance, etc.</p> <p>(Fall, Winter, Spring)</p>
<p>PH 105 Introductory Applied Physics I (4.0:3:3)</p> <p>Prerequisite: FDMAT 109 or higher</p> <p><i>This course is equivalent to PH 115.</i></p> <p>This course is the first semester of the algebra and trigonometry based Applied Physics sequence. While this course satisfies the physics requirement for most medical schools, it does not specifically address preparation for the MCAT exam. This course includes a three-hour lab.</p> <p>(Fall, Winter, Spring)</p>		<p>PH 127 Descriptive Astronomy (4.0:3:3)</p> <p>Astronomy is the study of the heavens and the Earth as a planet. This course introduces students to the wonders of the heavens and the fundamental observations, concepts, and theories of modern astronomy. Students also learn how scientists discover this information. Occasional use is made of the planetarium and observatory. This course includes a three hour lab.</p> <p>(Fall)</p>
<p>PH 106 Introductory Applied Physics II (4.0:3:3)</p> <p>Prerequisite: Ph 105</p> <p><i>This course is equivalent to PH 116.</i></p> <p>This course is the second semester of the algebra and trigonometry based Applied Physics sequence. This course includes a three-hour lab.</p> <p>(Fall, Winter, Spring)</p>		<p>PH 150 Beginning Physics Lab (1.0:0:3)</p> <p>Prerequisite: Concurrent registration or completion of PH 121.</p> <p>This course introduces students to the basics of experimental physics. It is designed to help students learn to think analytically and to gain experience in doing common experiments in physics. It teaches students how to analyze data and numerically model common physics problems.</p> <p>(Fall, Winter, Spring)</p>
<p>PH 115 Pre-Medical Professional Physics I (4.0:3:3)</p> <p>Prerequisite: FDMAT 109 or higher</p> <p><i>This course is equivalent to PH 105.</i></p> <p>A general course particularly designed for pre-medical students, but also appropriate for architecture, biology, and GE students. It is designed to address the concepts and topics needed to prepare students for the MCAT and entrance into professional schools. The style of MCAT physics questions is addressed directly. This course includes a three hour lab.</p> <p>(Fall, Winter, Spring)</p>		<p>PH 220 Principles of Physics III (3.0:2:3)</p> <p>Prerequisite: PH 121 or ME 204, concurrent registration or completion of Math 113 or Math 215.</p> <p>Third of a four semester sequence. Principles of electricity and magnetism with emphasis on combining intuition and past experience with mathematics to understand the laws of electricity and magnetism.</p> <p>(Fall, Winter, Spring)</p>
<p>PH 116 Pre-Medical Professional Physics II (4.0:3:3)</p> <p>Prerequisite: PH 115</p> <p><i>This course is equivalent to PH 106.</i></p> <p>Second course in a sequence of general physics particularly designed for pre-medical students, but also appropriate for architecture and biology students. It is designed to address the concepts and topics needed to prepare students for the MCAT and entrance into professional schools. The style of MCAT physics questions is addressed directly. This course includes a three hour lab.</p> <p>(Fall, Winter, Spring)</p>		<p>PH 250 Intermediate Physics Lab (1.0:0:3)</p> <p>Prerequisite: PH 150 and completion or concurrent registration of PH 220</p> <p>Intermediate Physics Laboratory for Physics and Physical Science Teaching Majors. Experimental investigations into electricity and magnetism.</p> <p>(Fall, Winter, Spring)</p>
<p>PH 117 Descriptive Acoustics of Music & Speech (4.0:3:3)</p> <p>Introductory acoustics course surveying the physical principles underlying the production and perception of sound, music and speech. It addresses basic measurements, vibrations, wave properties, superposition and spectra, perception and measurement, and room properties. Emphasis is placed on the experience, reasoning, and observations. This course includes a three-hour lab.</p> <p>(Winter)</p>		<p>PH 279 Modern Physics (3.0:2:3)</p> <p>Prerequisite: Completion or concurrent registration of PH 220</p> <p>Fourth of the principles of Physics sequence. Introductory course dealing with the fundamental topics of modern physics, including special relativity, elementary quantum mechanics, nuclear physics, and some particle physics.</p> <p>(Fall, Winter, Spring)</p>
<p>PH 121 Principles of Physics I (3.0:2:3)</p> <p>Prerequisite: Concurrent registration or completion of Math 112.</p> <p>This course is the first semester of the calculus-based Principles of Physics sequence. The course is designed for students majoring in physics, engineering, chemistry and mathematics. The course centers on mechanics, the study of forces and motion as described through Newton's three laws of motion and the concept of energy. This area of study is the foundation upon which nearly all science and technology is built. We use Newton's laws to design cars, airplanes, bridges, etc. Understanding electricity and magnetism, thermodynamics, and all other areas of Physics (and technology) depends on a firm understanding of the topics presented in this course.</p> <p>(Fall, Winter, Spring)</p>		<p>PH 291 Wave Physics (2.0:2:0)</p> <p>Prerequisite: Concurrent registration or completion of Math 316 or Math 371, and concurrent registration or completion of PH 279</p> <p>Physics course that reviews mathematical methods in the context of wave phenomena. Prepares students for the mathematical rigors of upper division physics.</p> <p>(Winter)</p>
		<p>PH 311 Physics By Inquiry I (3.0:2:3)</p> <p>Prerequisite: Junior level standing or permission of the instructor.</p> <p>This hands-on course covers selected topics in physics with emphasis on depth of understanding and developing skills essential to the scientific process. The skills include observation, interpretation, reasoning, generalizing, predicting, questioning and related communication skills. It provides an experience in education by inquiry, and background for teaching as a process of inquiry.</p> <p>(Fall)</p>

Physics

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<p>PH 314 History/Philosophy of Science (3.0:3:0) Prerequisite: Must have completed Physical Science GE course and lab or FDSCI 101 and FDSCI Issues courses This course discusses the philosophical foundations of modern science, including the relationship between observations and theory, criteria for theory selection, and the assumptions upon which science is built. It traces the historical development of this foundation and describes the strengths and limitations of modern science. It also describes the historical development of fundamental scientific ideas. (Fall, Winter)</p>	<p>PH 398R Physics Internship (1.0-3.0:0:0) Prerequisite: PH 328 or Instructor permission A professional internship providing the student with job experience in a physics-related field. (Spring)</p>
<p>PH 323 Solid State Physics (3.0:3:0) Prerequisite: PH 279, Math 316 or equivalent This in-depth course introduces the basic mathematical and conceptual tools necessary to study the structural, electrical, thermal, and mechanical properties of matter in the solid state. (Fall)</p>	<p>PH 403 Methods of Physics Teaching (3.0:3:0) Prerequisite: PH 279 and PH 314 Methods and philosophy of teaching physics principles in a high school setting. (Fall)</p>
<p>PH 324 Nuclear and Particle Physics (3.0:3:0) Prerequisite: PH 279 This is a junior level survey course which introduces the physics of atomic nuclei and elementary particles. (Fall)</p>	<p>PH 405 Numerical Modeling in Physics (2.0:1:3) Prerequisite: PH 279, PH 336 A lab course that applies numerical modeling and methods to a variety of modern topics in physics. MATLAB is used in the course. (Fall)</p>
<p>PH 328 Introduction to Physics Research (2.0:2:0) Prerequisite: PH 220, Math 214 or Math 316, & FDCOM 201 Introduces students to the research process in physics. Acquaints students with possible career tracks in physics. Begins or models the senior thesis or internship process. (Fall)</p>	<p>PH 406 Physics Senior Research (1.0:1:0) Prerequisite: PH 328 & Consent of Instructor. Students propose, develop the background for, and execute a research project culminating in production of a thesis (written in PH 488), either individually or in cooperation with other students. This project is in lieu of (or in addition to with approval) a professional internship. (Fall)</p>
<p>PH 332 Classical Mechanics (4.0:4:0) Prerequisite: PH 220, Math 214 or Math 316, & FDCOM 201 This is a junior level course applying Newton's Laws of Motion in a wide variety of applications. (Fall)</p>	<p>PH 411 Physics by Inquiry II (3.0:2:3) Prerequisite: Ph 311 This hands-on course continues coverage in selected topics in physics with emphasis on depths of understanding and developing skills essential to the scientific process. These skills include observation, interpretation, reasoning, generalizing predicting, questioning, and related communication skills. It provides an experience in education by inquiry and background for teaching as a process of inquiry. Opportunity may exist to practice appropriate questioning skills. (Fall)</p>
<p>PH 333 Electricity & Magnetism (4.0:4:0) Prerequisite: Physics 220, Math 316 or Math 371 This is a junior level course which covers electromagnetic theory. (Fall)</p>	<p>PH 433 Quantum Mechanics (3.0:3:0) Prerequisite: PH 279, Math 316 or Math 371 This is a senior-level course which covers an introduction to the theory of quantum mechanics. (Fall)</p>
<p>PH 336 Advanced Physics Lab (2.0:0:6) Prerequisite: Physics 250, concurrent registration or completion of PH 332. This course introduces students to the basics of computer interfacing. It is designed to teach students the limitations and advantages of using computers to collect and analyze experimental data. It will also teach the basic electronics and programming needed to interface an experiment to a computer. (Winter)</p>	<p>PH 473 Atomic and Solid State Physics (3.0:3:0) Prerequisite: Physics 433 This is a senior-level course which covers applications of the theory of quantum mechanics to atomic and solid state physics topics. (Winter)</p>
<p>PH 372 Thermal and Statistical Physics (3.0:3:0) Prerequisite: PH 332 This is a junior level course covering classical thermodynamics and statistical mechanics. This class builds upon and expands some of the material that was covered in Physics 123. (Winter)</p>	<p>PH 488 Senior Thesis (1.0:1:0) Prerequisite: Ph 398R, PH 406 A course focused on bringing a student's research experience to conclusion by writing the formal thesis and presenting its contents to the faculty and other students. (Winter)</p>
<p>PH 374 Astrophysics (3.0:3:0) Prerequisite: PH 279, PH 332 This is a junior level course which exposes the student to the field of introductory astrophysics. (Winter)</p>	
<p>PH 375 Principles of Optics (3.0:3:0) Prerequisite: PH 291, PH 333, and Math 316 or Math 472 This course covers the fundamental principles of optics. Beginning with Maxwell's Equations, the electromagnetic theory of light is studied. Fundamentals of geometric optics are revisited using electromagnetic theory. Phenomena such as polarization, interference, diffraction, and coherence are discussed. The course will also cover linear systems, and the techniques of Fourier Optics. (Winter)</p>	