Welcome to the BYU-Idaho Physics Department

Student Handbook

ROM 118
208.496.7730
www.byui.edu/physics

Welcome to the Physics Department

Welcome to BYU-Idaho's Physics Department. We are excited to get to know you and help you discover the world of Physics. Within our department we strive to develop reasoning, mathematical, and communication skills within a rigorous academic program while maintaining a student-oriented environment to prepare students for their chosen profession. Every class is specifically designed to develop those skills while teaching students the principles of physics.

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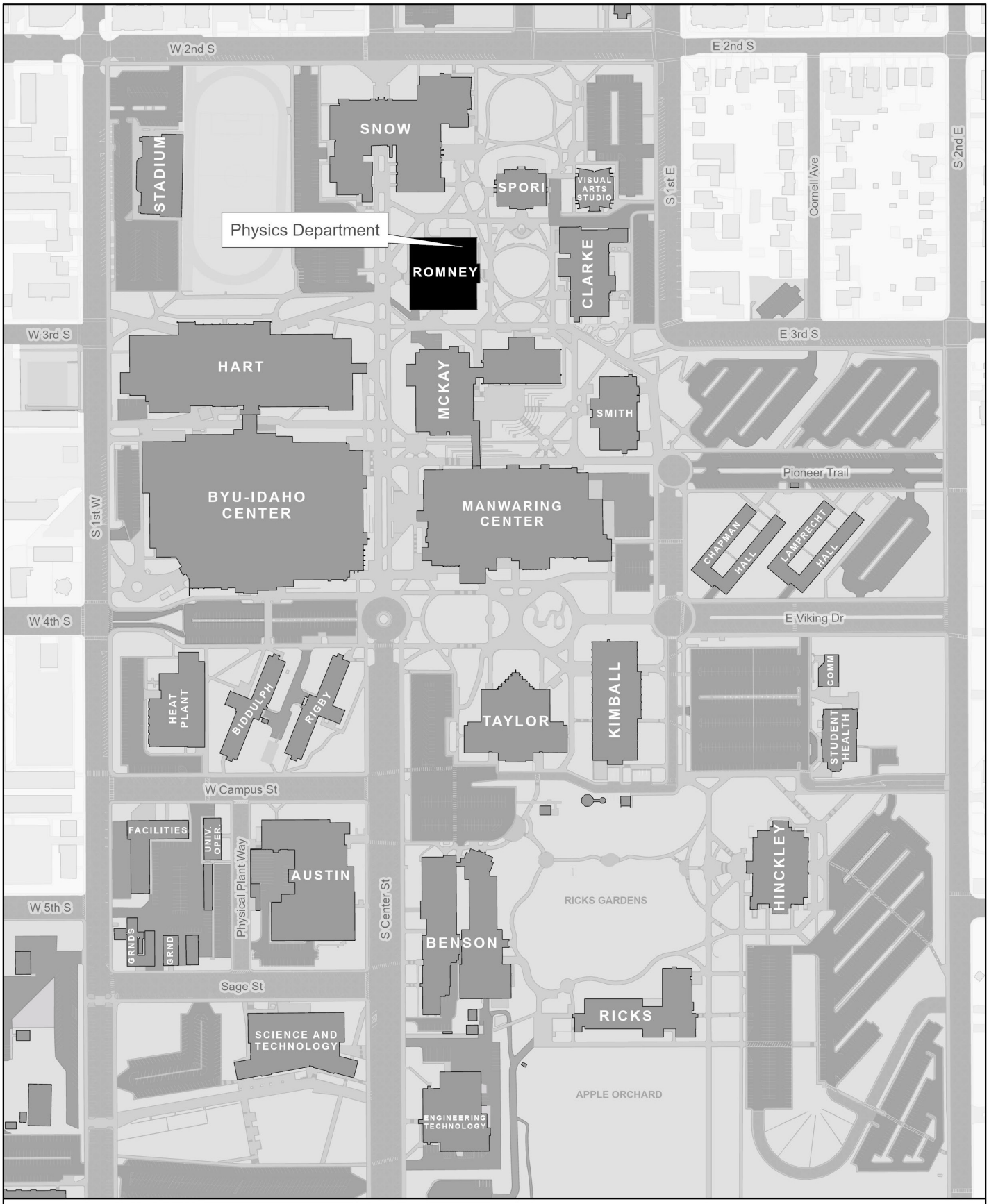
BYU-Idaho Campus Map



What Every Freshman Physics Major Should Know

In speaking with our graduating seniors, we have found a reoccurring theme. Many wished they would have known certain things as freshman instead of as seniors. Below are just a few of the main tips we hope all of our students know, but especially our new freshman.

1- **Ask Questions**: If ever you feel lost or don't know what to do come ask us. The Physics Department is located in ROM 118. Sister Nelson is happy to field your questions, answer what she can, or get you in contact with someone who knows. It's really true, you'll never know unless you ask.

2- **Get to know the Faculty:** Your physics instructors are great resources. Did you know that a physics faculty member should be assigned to you as a faculty mentor? Find out who they are (or come see Sis. Nelson and she can help you) and go introduce yourself. Ask them about a career in physics, or how to set up your grad plan. Make sure they know who you are and that you're a physics major. Too often we don't get to know you until the upper division courses so speak up and make yourself known early.

3- **Get involved**: There are a lot of things going on all the time in our department:

- We have a department I-Learn course in Canvas where all of our upcoming activities and resources are posted. You should be automatically enrolled by virtue of being a physics major. If you're not seeing it, come see Sis. Nelson in ROM 118 to get added.

- Join the Society of Physics Students right away. Get on their email list, Facebook group, and I-Learn site so you can stay up to date on upcoming activities.

- Start asking about and getting involved in some of the research projects we have going on (look on pg 28).

- Be a Grader, TA, or Tutor. Nothing will help you remember and retain the skills you've learned more than having the chance to review them often. And getting paid to do it doesn't hurt either.

- Attend the monthly Colloquium. In the Fall and Winter semesters we host a colloquium once a week at 11:30 am in ROM 172. This is a great opportunity to learn about cutting edge research, possible internship and graduate school opportunities, and do a little networking.

- Actively look for and participate in the STEM and Career Fairs sponsored by the College. These are great places to get connected with grad schools, potential employers, and just learn what's available. Seats fill up fast so be proactive.

4- **Educate yourself and plan ahead**: Don't wait until it's too late to find out you can't register because of a hold or prerequisite, or didn't know how to sequence your classes. Visit our college's advising center. Find out about track adjustments and when to apply for them. Use our Recipe for Success card to help remind you to always be planning ahead, looking forward, and being prepared for what is next.

Recipe for Success

1- Counsel with your Faculty Mentor regularly

2- Maintain a **high GPA** (higher than 3.5)

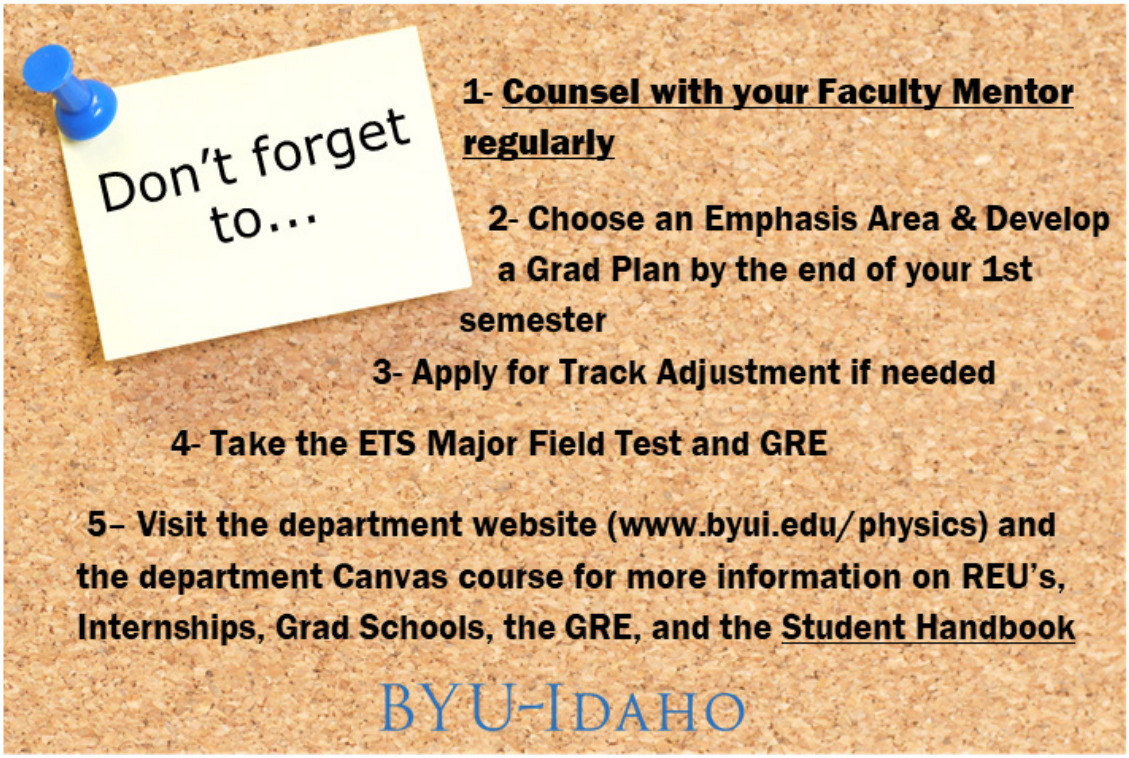
3– Get involved in **SPS** (Society of Physics Students)

4- Get involved in **Research** early

5- Develop relationships with Physics Professionals by attending Colloquia and conferences. (**Network**)

6- Apply for several (12 or more) **internships** as early as the end of your 2nd Physics year

7– Obtain a high **GRE** score



Physics Emphasis and Degree Information

In the Physics Department there are several different emphases that you can select to accompany your physics major. These emphasis areas include astronomy, computational, engineering, mathematical, and medical and heath.

The following pages show you the courses required with each emphasis and a recommended graduation plan. It is essential to follow the sequencing shown in this grad plan. In order to graduate in a timely manner, you need to start your own grad plan in accordance with your chosen emphasis as a freshman. Talk with your faculty mentor to ensure you have courses sequenced properly and to help you avoid getting caught in a pickle. Also, as you explore the emphasis areas, be sure to talk with your mentor about possible substitutions and ways to customize an emphasis area to better suit your career goals.

The following faculty members have been assigned to oversee the emphasis areas. **These may or may not be your personal faculty mentor**, but they can help you understand what's going on in that area and what jobs etc. are available:

Emphasis Areas and the Corresponding Faculty:

Emphasis:	Faculty:	Office:	Phone:
Astronomy	Stephen McNeil	ROM 259	208.496.7741
Computational	Lance Nelson	ROM 296	208.496.7736
Engineering	Todd Lines	ROM 180	208.496.7740
Mathematical	Richard Hatt	ROM 110	208.496.7738
Medical & Health	Kevin Kelley	ROM 184	208.496.7739

Program Notes:

- No Grade Less Than C- in Major Courses, and No Double Counting Major Courses.
- All majors are required to take the ETS Major Field Test with a minimum score in the 20% percentile or higher in order to graduate.
- Some upper division courses are offered on a rotating schedule, so please plan accordingly.
- PH 121 and MATH 112x double count and fulfills the GE requirement for given area.
- Students are encouraged to take MATH 113 and MATH 214 in place of MATH 215 if desired.
- Substitutions may be needed if you are on a previous catalog year. See your faculty mentor for more information.

Astronomy Emphasis (770-154)

770 Physics Major Core Requirements = 55 credits

All physics majors must take the following core classes as well as select one of the five emphasis areas to complete the degree requirements.

Course	Credits		Course	Credits		Course	Credits
MATH 112X	4		PH 220	3		PH 336	2
MATH 215	4		PH 228	1		PH 373	3
MATH 316	4		PH 250	1		PH 385	2
PH 121	3		PH 279	3		PH 412	3
PH 123	3		PH 295	2		PH 433	3
PH 135	2		PH 332	3		PH 398R or PH 406	1
PH 150	1		PH 333	3		PH 488	1
PH Elective Courses							
Choose one:			PH 314	3		PH 374	3
Note: No double counting with Emphasis Area			PH 323	3		PH 375	3
			PH 324	3		PH 473	3

Astronomy Emphasis Area Requirements = 12 credits

Course	Credits
Take the following:	
PH 127	3
PH 277	3
PH 374	3
MATH 472	3

Graduation Plan for Astronomy (770-154)

Semester 1		Semester 2		Semester 3		Semester 4		Semester 5	
PH 135	2	MATH 215	4	MATH 316	4	PH 279	3	PH 332	3
PH 121	3	PH 123	3	PH 220	3	PH 295	2	PH 333	3
PH 127	3	PH 150	1	PH 228	1	ENG 301	3	REL 275C	2
MATH 112X	4	ENG 150	3	PH 250	1	REL 250C	2	GE Breadth	3
BYUI 101	1	REL 225C	2	PH 277	3	GE Breadth	3	Elective Credit	3
REL 200C	2	Elective Credit	2	Elective Credit	3	Elective Credit	3		
	15		15		15		16		14

Semester 6		Off-Track		Semester 7		Semester 8		Program Notes
PH 336	2	**Choose One:		PH 412	3	PH 488	1	*PH 374 is required for this emphasis. A different PH Elective is required for the core requirement.
PH 373	3	PH 398R or	1	PH 433	3	*PH Elective	3	
*PH 374	3	PH 406		GE Breadth	3	MATH 472	3	
PH 385	2			REL Elective	2	GE Breadth	3	
REL Elective	2			Elective Credit	3	REL Elective	2	
Elective Credit	3					Elective Credit	3	
	15		1		14		15	

Computational Emphasis (770-157)

770 Physics Major Core Requirements = 55 credits

All physics majors must take the following core classes as well as select one of the five emphasis areas to complete the degree requirements.

Course	Credits		Course	Credits		Course	Credits
MATH 112X	4		PH 220	3		PH 336	2
MATH 215	4		PH 228	1		PH 373	3
MATH 316	4		PH 250	1		PH 385	2
PH 121	3		PH 279	3		PH 412	3
PH 123	3		PH 295	2		PH 433	3
PH 135	2		PH 332	3		PH 398R or PH 406	1
PH 150	1		PH 333	3		PH 488	1
PH Elective Courses							
Choose one:			PH 314	3		PH 374	3
Note: No double counting with Emphasis Area			PH 323	3		PH 375	3
			PH 324	3		PH 473	3

Computational Emphasis Area Requirements = 12 credits

Course	Credits	Course	Credits
Take 12 credits from:			
CSE 110	2	ITM 112	2
CSE 111	2	MATH 411	3
CSE 210	2	MATH 412	3
CSE 212	2	CSE 450	3
CSE 220C	1	DS 250	2
CSE 280	2	DS 350	3
CSE 351	2	DS 460	3

Graduation Plan for Computational (770-157)

Semester 1		Semester 2		Semester 3		Semester 4		Semester 5	
PH 135	2	MATH 215	4	Math 316	4	PH 279	3	PH 332	3
PH 121	3	PH 123	3	PH 220	3	PH 295	2	PH 333	3
PH 150	1	PH 228	1	PH 250	1	Comp Emph	3	GE Breadth	3
MATH 112X	4	Comp Emph	2	Comp Emph	2	REL 250C	2	REL 275C	2
BYUI 101	1	ENG 150	3	REL 225C	2	Elective Credit	4	Elective Credit	4
GE Breadth	3	REL 200C	2	ENG 301	3				
	14		15		15		14		15
Semester 6		**Off-Track**		**Semester 7**		**Semester 8**		**Program Notes**	
PH 336	2	**Choose		PH 412	3	PH 488	1		
PH 373	3	One:	1	PH 433	3	PH Elective	3		
PH 385	2	PH 398R or		Comp Emph	3	Comp Emph	2		
GE Breadth	3	PH 406		REL Elective	2	GE Breadth	3		
REL Elective	2			Elective Credit	4	REL Elective	2		
Elective Credit	4					Elective Credit	4		
	16		1		15		15		

Engineering Emphasis (770-158)

770 Physics Major Core Requirements = 55 credits

All physics majors must take the following core classes as well as select one of the five emphasis areas to complete the degree requirements.

Course	Credits		Course	Credits		Course	Credits
MATH 112X	4		PH 220	3		PH 336	2
MATH 215	4		PH 228	1		PH 373	3
MATH 316	4		PH 250	1		PH 385	2
PH 121	3		PH 279	3		PH 412	3
PH 123	3		PH 295	2		PH 433	3
PH 135	2		PH 332	3		PH 398R or PH 406	1
PH 150	1		PH 333	3		PH 488	1
PH Elective Courses							
Choose one:			PH 314	3		PH 374	3
Note: No double counting with Emphasis Area			PH 323	3		PH 375	3
			PH 324	3		PH 473	3

Engineering Emphasis Area Requirements = 12 credits

Course	Credits	Course	Credits
Take the following course(s)			
CHEM 105	3	ME 201	3
Take at least 9 credits from:		ME 202	3
ECEN 100	2	ME 250	3
ECEN 150	3	ME 322	3
ECEN 240	3	ME 360	3
ECEN 250	3	ME 422	3
ECEN 350	3	ME 423	3

Graduation Plan for Engineering (770-158)

Semester 1		Semester 2		Semester 3		Semester 4		Semester 5	
PH 135	2	MATH 215	4	Math 316	4	PH 279	3	PH 332	3
PH 121	3	PH 123	3	PH 220	3	PH 295	2	PH 333	3
PH 150	1	CHEM 105	3	PH 228	1	Eng Emphasis	3	GE Breadth	3
MATH 112X	4	ENG 150	3	PH 250	1	REL 250C	2	REL 275C	2
BYUI 101	1	REL 200C	2	REL 225C	2	Elective Credit	4	Elective Credit	4
GE Breadth	3			ENG 301	3				
	14		15		14		14		15
Semester 6		**Off-Track**		**Semester 7**		**Semester 8**		**Program Notes**	
PH 336	2	**Choose		PH 412	3	PH 488	1		
PH 373	3	One:	1	PH 433	3	PH Elective	3		
PH 385	2	PH 398R or		Eng Emphasis	3	Eng Emphasis	3		
GE Breadth	3	PH 406		REL Elective	2	GE Breadth	3		
REL Elective	2			Elective Credit	4	REL Elective	2		
Eelctive Credit	4					Elective Credit	4		
	16		1		15		16		

Mathematical Emphasis (770-165)

770 Physics Major Core Requirements = 55 credits

All physics majors must take the following core classes as well as select one of the five emphasis areas to complete the degree requirements.

Course	Credits		Course	Credits		Course	Credits
MATH 112X	4		PH 220	3		PH 336	2
MATH 215	4		PH 228	1		PH 373	3
MATH 316	4		PH 250	1		PH 385	2
PH 121	3		PH 279	3		PH 412	3
PH 123	3		PH 295	2		PH 433	3
PH 135	2		PH 332	3		PH 398R or PH 406	1
PH 150	1		PH 333	3		PH 488	1
PH Elective Courses							
Choose one:			PH 314	3		PH 374	3
Note: No double counting with Emphasis Area			PH 323	3		PH 375	3
			PH 324	3		PH 473	3

Mathematical Emphasis Area Requirements = 12 credits

Course	Credits	Course	Credits
Take 12 credits from:			
MATH 301	3	MATH 443	3
MATH 330	3	MATH 461	3
MATH 341	3	MATH 462	3
MATH 423	3	MATH 463	3
MATH 424	3	MATH 472	3
MATH 441	3		

Graduation Plan for Mathematical (770-165)

Semester 1		Semester 2		Semester 3		Semester 4		Semester 5	
PH 135	2	MATH 215	4	Math 316	4	PH 279	3	PH 332	3
PH 121	3	PH 123	3	PH 220	3	PH 295	2	PH 333	3
PH 150	1	ENG 150	3	PH 228	1	MATH Emphasis	3	GE Breadth	3
MATH 112X	4	REL 200C	2	PH 250	1	REL 250C	2	REL 275C	2
BYUI 101	1	Elective Credit	3	ENG 301	3	GE Breadth	3	Elective Credit	3
GE Breadth	3			REL 225C	2	Elective Credit	3		
	14		15		14		16		14

Semester 6		Off-Track		Semester 7		Semester 8		Program Notes
PH 336	2	**Choose One:		PH 412	3	PH 488	1	Take care to plan out which math courses you choose for the emphasis area as many are only offered once a year or every other year.
PH 373	3	PH 398R or	1	PH 433	3	PH Elective	3	
PH 385	2	PH 406		MATH Emphasis	3	MATH Emphasis	3	
MATH Emphasis	3			REL Elective	2	GE Breadth	3	
REL Elective	2			Elective Credit	4	REL Elective	2	
Elective Credit	4					Elective Credit	3	
	16		1		15		15	

Medical Emphasis (770-166)

770 Physics Major Core Requirements = 55 credits

All physics majors must take the following core classes as well as select one of the five emphasis areas to complete the degree requirements.

Course	Credits		Course	Credits		Course	Credits
MATH 112X	4		PH 220	3		PH 336	2
MATH 215	4		PH 228	1		PH 373	3
MATH 316	4		PH 250	1		PH 385	2
PH 121	3		PH 279	3		PH 412	3
PH 123	3		PH 295	2		PH 433	3
PH 135	2		PH 332	3		PH 398R or PH 406	1
PH 150	1		PH 333	3		PH 488	1
PH Elective Courses							
Choose one:			PH 314	3		PH 374	3
Note: No double counting with Emphasis Area			PH 323	3		PH 375	3
			PH 324	3		PH 473	3

Medical Emphasis Area Requirements = 12 credits

Course	Credits
Take the following:	
PH 324	3
CHEM 105	3
BIO 264	3
BIO 265	3

Graduation Plan for Medical (770-166)

Semester 1		Semester 2		Semester 3		Semester 4		Semester 5	
PH 135	2	MATH 215	4	Math 316	4	PH 279	3	PH 332	3
PH 121	3	PH 123	3	PH 220	3	PH 295	2	PH 333	3
PH 150	1	ENG 150	3	PH 228	1	GE Breadth	3	BIO 264	3
MATH 112X	4	GE Breadth	3	PH 250	1	REL 250C	2	REL 275C	2
BYUI 101	1	REL 200C	2	REL 225C	2	ENG 301	3	Elective Credit	3
GE Breadth	3			Elective Credit	4	Elective Credit	3		
	14		15		15		16		14
Semester 6		**Off-Track**		**Semester 7**		**Semester 8**		**Program Notes**	
PH 336	2	**Choose		*PH 324	3	PH 488	1	*PH 324 is required	
PH 373	3	One:	1	PH 412	3	PH Elective	3	for this emphasis.	
PH 385	2	PH 398R or		PH 433	3	CHEM 105	3	A different PH	
BIO 265	3	PH 406		REL Elective	2	GE Breadth	3	Elective is required	
REL Elective	2			Elective Credit	4	REL Elective	2	for the core	
Elective Credit	3					Elective Credit	3	requirement.	
	15		1		15		15		

Course Descriptions and Availability

PH 101 Fundamentals of Physics (3:3:0:0)

This course is an introductory physics course for non-science majors. This course focuses on basic physics concepts and principles and how they connect to everyday life. Course topics include Newtonian mechanics, heat and temperature, electricity and magnetism, light and sound, nuclear radiation, and relativity.
(Fall, Winter, Spring)

PH 105 Introductory Applied Physics I (4:3:4:0)
Prerequisite: MATH 109 or MATH 110X or MATH 112X or ALEKS score of 85

This is an algebra-based introductory general physics course, including a lab component. Also, target students for this course include those interested in pre-med, dental, physical therapy, construction management, and so on. This course contains a lab component.
(Fall, Winter, Spring)

PH 106 Introductory Applied Physics II (4:3:4:0)
Prerequisite: PH 105

This is the second course in an algebra-based introductory physics sequence that targets students who are interested in pre-med, dental, physical therapy, construction management, and so on. This course contains a lab component.

(Fall, Winter, Spring)

PH 121 Principles of Physics I (3:2:3:0)
Corequisite: MATH 112X

This is the first course 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.

(Fall, Winter, Spring)

PH 123 Principles of Physics II (3:2:3:0)
Prerequisite: PH 121
Corequisite: MATH 112X
This is the second course of the calculus-based Principles of Physics sequence. It is designed for students majoring in physics, chemistry, geology, civil engineering, and mathematics. The course covers topics in waves, thermodynamics, and optics.
(Fall, Winter, Spring)

PH 127 Introduction to Astronomy (3:2:2:0)

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 in a historical context.

(Fall, Spring)

PH 135 Introduction to Scientific Computing in Physics (2:1:2:0)
Students will learn basic computer programming skills in Python with a concerted emphasis on STEM-related problems and applications. Students will gain extensive experience working in jupyter notebooks and homework problem sets will involve introductory-level physics and mathematics. The course will also serve as an introduction to the physics major and the many career options that the degree offers. Students will gain confidence in their degree and start making educational plans to match their career goals.

(Fall, Winter, Spring)

PH 150 Beginning Physics Lab (1:0:3:0)
Corequisite: PH 121

This course is an introduction to the basics of experimental physics, including the role of experimentation, measurement of uncertainty, data analysis, numerical modeling, and experiment design.

(Fall, Winter, Spring)

PH 205 Physics By Inquiry (3:1:4:0)

This guided inquiry course addresses selected topics in physics with emphasis on the depth 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.
(Fall odd years)

PH 220 Principles of Physics III (3:2:3:0)
Prerequisite: PH 121
Corequisite: MATH 113 or MATH 215

This is the third course of the calculus-based Principles of Physics sequence. It is designed for students majoring in physics and other sciences. This course covers topics in electricity and magnetism with emphasis on combining intuition and past experience with mathematics to understand the laws of electricity and magnetism.

(Fall, Winter, Spring)

PH 223 Engineering Physics (4:3:2:0)
Prerequisite: PH 121 and MATH 113 or MATH 215

This course is designed for students majoring in mechanical engineering and chemistry. It is a one-semester calculus based physics course covering topics in waves, electricity, magnetism, and optics.

(Fall, Winter, Spring)

PH 228 Physics Career Development (1:0:3:0)
Prerequisite: PH 121 and ENG 150
This course acquaints students with possible career tracks in physics. It introduces topics with becoming a member of a professional community, including presentation and other written communication. Students begin developing skills for job or graduate school applications and interviews. This course introduces students to the research process in physics by beginning the senior thesis or internship process.
(Fall)

PH 250 Intermediate Physics Lab (1:0:3:0)
Prerequisite: PH 150
Corequisite: PH 220 or PH 223

This course is an introduction to the use of microprocessors, analog to digital converters, and embedded programming in experimental physics.

(Fall, Winter, Spring)

PH 277 Contemporary Issues in Astronomy (3:2:2:0)
Prerequisite: PH 127

This course explores areas of current interest in astronomy, focusing on the formation of our solar system, exoplanets, and cosmology. It builds on the principles of astronomy learned previously in PH 127.

(Fall)

PH 279 Modern Physics (3:2:3:0)
Prerequisite: PH 123
Corequisite: PH 220

This course is the fourth in the Principles of Physics sequence. It is an introductory course dealing with the fundamental topics of modern physics, including special relativity, elementary quantum mechanics, nuclear physics, and some particle physics.

(Winter, Spring)

PH 290R Special Problems in Physics (1-3:1:2:0)
Requirement: Instructor Approval Required
This special topics course is a one to three credit, repeatable course that can be tailored to learning in areas that are not currently part of the required physics program. It is an elective course for those who express interest in learning more about a specific topic in physics or astronomy. Topics will be chosen by the professor. The course will be most often be a lecture type experience, but may include student projects.
(Winter, Spring)

PH 295 Mathematical/Computational Methods (2:1:3:0)
Prerequisite: PH 135
Corequisite: PH 279 and MATH 316
This course is the second in a series of three computational courses offered by the physics department. The course has a numerical component that covers various numerical algorithms (coding taught in Python) and a mathematical component to prepare students for the mathematical rigors of upper division physics classes.
(Winter, Spring)

PH 314 History and Philosophy of Science (3:3:0:0)
Course equivalent to PHIL 314
Prerequisite: ENG 150
This course describes modern science as a tool for studying the physical universe. It addresses three main philosophical questions: What is science? What ideas/concepts do we take for granted in science? How do scientists establish their claims? It uses the history of science, which shows how science actually developed, to address these critical questions.

(Fall even years)

PH 323 Solid State Physics (3:3:0:0)
Prerequisite: MATH 316 and PH 279
This 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 odd years)

PH 324 Nuclear and Particle Physics (3:3:0:0)
Prerequisite: PH 279

This is a junior level survey course which introduces the physics of atomic nuclei and elementary particles.

(Fall even years)

PH 332 Classical Mechanics (3:2:3:0)
Prerequisite: PH 220 and MATH 316
This is a junior level course applying Newton's Laws of Motion in a wide variety of applications. It also includes a lab component that includes hands-on experience (experiential learning).
(Fall)

PH 333 Electricity and Magnetism (3:3:0:0)
Prerequisite: PH 220 and MATH 316

The course will cover the following topics in electricity and magnetism: electrostatics, electric fields in matter, electric potential, magnetostatics, and magnetic fields in matter. We will also develop mathematical skills in using: method of images, multipole expansions, separation of variables, multivariable vector calculus.

(Fall)

PH 336 Advanced Physics Lab (2:0:6:0)
Prerequisite: PH 250

This course prepares students to do experimental work for their internship and/or research level, including advanced techniques for the analysis of experimental data and the operation of common equipment used in modern physics experiments.

(Winter)

PH 373 Electricity and Magnetism II (3:3:0:0)
Prerequisite: PH 333

This course is designed as the second half of an introduction to electrodynamics, and includes the topics of electromagnetic waves, potentials, dipole radiation, and relativistic electrodynamics. Integral to this course are systematic problem solving techniques using vector calculus.

(Winter)

PH 374 Astrophysics (3:3:0:0)
Prerequisite: PH 277
Corequisite: PH 279

A junior level mathematically based course designed to introduce students to the field of astrophysics.

(Winter even years)

PH 375 Principles of Optics (3:3:0:0)
Prerequisite: PH 333

This course covers the fundamental principles of optics and builds upon material covered in Physics 123. Both geometric optics and wave optics are covered in the class. Phenomena such as lens aberrations, polarization, interference, diffraction, and coherence are discussed. Students will gain hands-on experience with weekly labs and there will also be computational applications.

(Winter odd years)

PH 385 Numerical Modeling in Physics (2:1:3:0)
Prerequisite: PH 279 and PH 295

A lab course designed to expose students to the topic of numerical modeling in the context of a variety of relevant physical situations. One or more of the following program languages will be used in this course: MATLAB, PYTHON, C , or FORTRAN.

(Winter)

PH 390R Special Topics in Physics (1:0:2:0)
Course is Repeatable for Credit
Max Credits: 6
Prerequisite: PH 121

This special topics course is one credit, repeatable course that can be tailored to student mentored research projects. It is an elective course for those who express interest in learning more about a special topic in physics or astronomy.

(Fall, Winter, Spring)

PH 398R Physics Internship (1:0:0:0)
Course is Repeatable for Credit
Max Credits: 2
Registration Requirement: Internship application authorization

This course consists of a professional internship providing the student with job experience in a physics-related field.

(Fall, Winter, Spring)

PH 406 Physics Senior Research (1:1:0:0)
Course Requirement: Instructor Approval Required

In this course 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, Winter, Spring)

PH 412 Thermal and Statistical Physics (3:3:0:0)
Prerequisite: PH 279 and PH 295

This is a senior level course covering classical thermodynamics and statistical mechanics. This course builds upon and expands some of the material that was covered in PH 123.

(Fall)

PH 433 Quantum Mechanics (3:3:0:0)
Prerequisite: PH 279 and PH 295
This course is a formal introduction to the postulates of quantum mechanics, with an emphasis on application in one-dimensional systems.
(Fall)

PH 473 Atomic Physics (3:3:0:0)
Prerequisite: PH 433

This course is an extension of the postulates of quantum mechanics to multi-dimensional systems, including applications of the theory to atomic, and solid state, and other advanced physics topics.

(Winter even years)

PH 488 Senior Thesis (1:1:0:0)
Prerequisite: PH 406 or PH 398R and ENG 301 or BUS 301
Course Requirement: Instructor Approval Required
This is 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.

(Fall, Winter, Spring)

Professional Development Plan

Freshman		Sophomore		Junior		Senior	
Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
1. Contact an Alumni Mentor 2. Find your Faculty Mentor 3. Select an emphasis area - 1st semester 4. Take College Success course 5. Complete & Approve Graduation Plan 6. Attend monthly Colloquia 7. Join Society of Physics Students		1. Take PH 228 - Physics Career Development course 2. Research Graduate Schools (Deadlines & Requirements) 3. Join a research group 4. Submit track adjustment - 4th Semester 5. Attend monthly Colloquia		1. Career Workshop - Succeeding in your Internship, Grad School, and Career 2. Prepare to take the GRE 3. Discuss internship with faculty mentor 4. Explain senior thesis requirement 5. Submit internship applications 6. Attend BYU-Provo STEM fair 7. Attend monthly Colloquia		1. Submit Job Applications 2. Submit Grad School Applications 3. Discuss grad school/career opportunities 4. Major Field Test- 8th semester 5. Attend BYU-Provo STEM fair 6. Attend monthly Colloquia 7. Exit interview 8. Attend Professional Conference 9. Become an Alumni mentor	

OFF TRACK ⬇

OFF TRACK ⬇

OFF TRACK ⬇

Off Track	Off Track	Off Track
Internship/Volunteer Experience	Internship/Research Experience	PH 398R Internship/PH 406 Research

Student Semester Checklist

Hello Physics Majors,

In an effort to better assist you with your educational plan, we're asking that you fill out this form and return it to your faculty mentor. In exchange, the registration hold on your student account will be lifted.

Name: I-Number:

I am currently a ◯ Freshman ◯ Sophomore ◯ Junior ◯ Senior

I have an approved Grad plan ◯ Yes ◯ No

If no, explain why not:

I am interested or involved in the following research area(s):

Below are requirements/activities we ask you to accomplish in each respective semester. Please find the matching semester you are registering for below and check the box that you have read the requested items and will fulfill them to the best of your ability.

Semester One	Semester Two	Semester Three	Semester Four
1: Review the Student Handbook at www.byui.edu 2: Begin developing grad plan 3: Attend Colloquia ◯	1: Confirm an emphasis area 2: Complete/submit a grad plan 3: Get involved with SPS 4: Become familiar with research opportunities 5: Attend Colloquia ◯	1: Become involved in research 2: Submit track adjustment form (if necessary) 3: Attend Colloquia ◯	1: Attempt early to secure an internship 2: Develop a resume and have it reviewed (Career Workshop) 3: Switch track to Fall/Winter 4: Attend Colloquia ◯

Semester Five	Semester Six	Semester Seven	Semester Eight
1: Research internships 2: Attend STEM Fair 3: Attend Colloquia ◯	1: Apply for 12 or more internships 2: Research graduate school and/or career opportunities 3: Practice interview skills (Career Workshop) 4: Attend Colloquia ◯	1: Understand the senior thesis requirements 2: Begin Graduate school and/or career applications 3: Take GRE if graduate school bound 4: Attend Colloquia ◯	1: Senior thesis and defense 2: Do exit survey 3: Join our Facebook and LinkedIn groups 4: Attend Colloquia ◯

Frequently Asked Questions

This is just a sample of the most frequently asked questions. For other questions or more in depth answers please feel free to contact the Physics Department Office at (208) 496-7730. Also please visit the BYU-Idaho Physics Department web page for more links and information.

Why can't I (a physics major) register for next semester?
All physics majors are required to meet with their faculty mentor each semester in order to be granted clearance to register. This meeting can be in person, via email or Zoom, or by phone. The purpose behind it is so we can help you stay on track, know your long-term goals, etc so we can help you get into the right classes, in the right sequence, and ready to graduate. Please come see Sis Nelson in ROM 118 if you need help finding your assigned faculty mentor.

What can I do with a degree in Physics?
A background in Physics opens up a wide variety of career opportunities. Nearly 90 percent of all "physicists" are working in medicine, education, industry, engineering, or other professions. Physicists are in demand for their analytical skills in many financial, fund management and research roles, in law, as weather forecasters, computer programmers, and as physics and science teachers. So in short, pretty much anything you want!

I am a Physics Major and was accepted to the Winter/Spring or Spring/Fall track.
We accept any track up through your sophomore year. In general, at the end of your sophomore year or at the beginning your junior year you will need to apply for a track adjustment so you can take the majors courses offered in the fall and winter semesters. Contact the department chair to get this process started.

Where do I go to change my major?
The Academic Advising Center for our college is located in MC 102. They can be contacted at 208.496.9880 or e-mailed at STEMadvising@byui.edu. You can also visit their website at www.byui.edu/advising. Their team can help you fill out all the forms, get you on the right track, and answer any questions about graduation and requirements.

Where do I go to get a course substitution?
The department chair can approve all physics course substitutions. If you have career goals that don't quite fit in the emphasis areas, course subsitutions are an option to make those goals a reality. Come to ROM 118A and talk with the chair for guidance and options.

What are PH 406 (Physics Senior Research) and PH 398R (Physics Internship)?
All physics majors are required to have an experience applying their learning in an on-the-job or in-the-lab setting. PH 398R is usually a paid applied or research experience away from campus. PH 406 is an unpaid on-campus faculty-mentored research experience. PH 398R is the preferred course and permission to add PH 406 is restricted to those that have exhausted every possible avenue for an internship and have completed 400 hrs of research.

How do I get access to the majors room and/or research room?

We have two specialzed rooms to help you learn and collaborate with fellow physics majors. The physics majors room is ROM 129. You must be taking PH 250 and above to be given access to this room. The physics research room is ROM 52. This room is where a majority of our research projects and collaboration takes place. As long as you are an active member of a research team you can gain access to this room. Both require a signed agreement form signed by you (and the faculty you're working with if its the research room). If you signed a form, then each semester look for the quizzes set up in I-Learn to renew that access. There is a quiz for each room, so if you want access to each, make sure you take both quizzes!

What is the ETS test and why do I have to take it?

The ETS Major Field test assesses the effectiveness of our program and evaluates students' mastery in their major field of study. We can compare our results to universities across the globe to ensure you are getting the best instruction and resources to help make you successful. These tests are paid for by the department and are given in the Winter semester in the upper division courses. They are also great practice and prepartion for you to take the GRE as they are similar exam structures.

What are PH 406 and PH 398R?

What is PH 398R?

All physics majors are required to have an experience applying their learning in an on-the-job or in-the-lab setting. PH398R fulfills this requirement via an off-campus experience. This can be a research experience (think national labs and research-focused universities) or an applied experience (think Boeing, Northrop Grumman, and Intel but not McDonalds or Burger King). It needs to be an organization other than this school and the work needs to be of the skilled variety, requiring the use of your newly-acquired technical skills.

You should start applying for internships during your sophomore year and consider applying again during your junior year, whether you've done one before or not. (Two internships are better than one) These internships provide a nice paycheck, prepare you for your future role in the workforce, and build your professional network, likely opening up lucrative and rewarding future opportunities. Internships for physics students are usually paid experiences. It is expected that an internship will be a high priority on your educational checklist and that you will exhaust every avenue in your endeavor to obtain one.

Well then what is PH 406?

If after honestly exhausting all avenues you are unable to obtain an away-from-campus internship experience you may become eligible to register for PH406 and fulfill the internship requirement via an on-campus faculty-mentored research experience. You can qualify for PH406 if

1. You can provide proof that you have made every effort to obtain an away-from-campus experience. This usually means that you have applied for at least 20 positions,

and

2. You have already completed at least 200 hours of research with your on-campus faculty research adviser or you are able to commit to the research project full-time (40 hours per week) for one full semester.

Only when both of these conditions have been met will you be allowed to register for PH406 as a substitute for PH398R.

Why not just take PH 406 instead of PH 398R?

The majority of physics students do not qualify for PH406. For those who do qualify, there are several significant drawbacks and/or challenges associated with replacing PH398R with PH406 that you should know about:

1. You will not be paid for the on-campus research experience.

2. The on-campus research experience must be equivalent to an internship experience (roughly 400 hours of work). This means that you will have to either i) engage in research part-time for 3 consecutive semesters (while you carry a full course load) or ii) engage in research full-time during your off-semester, thus forfeiting the opportunity to work for pay elsewhere during that time.

3. If you plan poorly and try to register for PH406 in the same semester that you begin your on-campus research experience (i.e. you fail to meet condition #2 from above), you will find that you will not be allowed to register at all. This scenario could delay your graduation for a full year.

4. You will not build your professional network and will miss out on building a bridge to a post-graduation position. This will make the post-graduation job search more difficult.

Please note that we are not discouraging you from engaging in research here on campus. In fact, we encourage your involvement in on-campus, faculty-mentored research as it will strengthen your applications for jobs and internships. However, we strongly discourage substituting a valuable, network-building, away-from-campus professional experience (PH398R) with a faculty-mentored, on-campus experience (PH406). Planning to do this will limit your post-graduation opportunities and put you at a disadvantage relative to your peers.

Internships Info

Getting an internship can be a daunting task, but hopefully the following links can help get you started. For more detailed information see Bro. Brian Tonks or the Internship office at http://www.byui.edu/internships.

NSF's list of physics REUs: http://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=69
(without the unitid=69 query *you'll get all programs like chemistry, physics, math, etc.*)

APS physics list of internships: http://www.aps.org/careers/employment/internships.cfm#undergrad

AAPT/SPS The Physics Nucleus (includes a forum to discuss internships, scholarships, etc.): http://www.compadre.org/student/

Grad School and GRE Info

Are you looking to go on to Graduate School after finishing your degree at BYU-Idaho? Here are some websites you might be interested in.

AIP's physics graduate school finding website (a paper copy of their catalog is kept in the physics majors room): http://www.gradschoolshopper.com/

GRE preparation suggestions from ETS for the general test: https://www.ets.org/gre/revised_general/prepare/

GRE preparation suggestions from ETS for the physics subject test: http://www.ets.org/gre/subject/about/content/physics

OSU's physics GRE preparation page with many past practice exams: http://www.physics.ohio-state.edu/undergrad/ugs_gre.php

Get Involved

Planetarium

The planetarium offers an opportunity to explore our universe through several different shows. See the stars, planets, and recognize constellations as they appear above you, just as if you were gazing at the night sky. We currently feature 17 shows in our planetarium. Most shows average 30 minutes in length. Public shows are offered every Thursday evening at 7:00 pm. Tickets go on sale at 6:30 pm at the door, first come, first served. Cost is $2.00 per person.

For more information or if you would like to get involved with the planetarium contact:
Stephen McNeil at mcneils@byui.edu or via phone at (208) 496-7741.

Observatory

We have a public telescope available on top of the Romney building, ROM 301. While the days and times it is open vary depending on the semester, in general the Observatory is:

- Closed on cloudy/overcast nights
- Open to the public
- Free of charge
- Operators are on duty to answer questions, point out constellations, and operate the telescope.

For further information regarding the Observatory contact:
Stephen McNeil at mcneils@byui.edu, or via phone at (208)496-7741.

Society of Physics Students

The Society of Physics Students (SPS) is a professional association explicitly designed for students. Membership, through collegiate chapters, is open to anyone interested in physics. The only requirement for membership is that you be interested in physics. The SPS exists to help students transform themselves into contributing members of the professional community. Course work develops only one range of skills. Other skills needed to flourish professionally include effective communication and personal interactions, leadership experience, establishing a personal network of contacts, presenting scholarly work in professional meetings and journals, and outreach services to the campus and local communities.

For more information or if you would like to get involved with this society contact:
Jon Johnson at johnsonjo@byui.edu, or via phone at (208)496-7759.

Student Research Opportunities

There are many exciting areas of research in the field of physics. Here are a few examples of research projects currently going on in our department. When in doubt ask your favorite physics teachers what's going on and how you can get involved.

Acoustics

For further information, please contact Bro Johnson at johnsonjo@byui.edu
or via phone at (208) 496-7759

Astronomical Observations

For further information, please contact Bro McNeil at mcneils@byui.edu,
or via phone at (208) 496-774.

Atmospheric Optics

For further information, please contact Bro Lines at linest@byui.edu
or via phone at (208) 496-7740.

Carbon Nanaotubes

For further information, please contact Bro Hansen at hansenev@byui.edu
or via phone at (208) 496-7737.

High Altitude Research Team (HART Balloon Project)

For further information, please contact Bro Pyper at pyperb@byui.edu
or via phone at (208) 496-7744.

High Performance Computing

For further information, please contact Bro Hill at hilljo@byui.edu
or via phone at (208) 496-7750.

Materials Simulation- Grain Boundaries

For further information, please contact Bro Hansen at hansenev@byui.edu
or via phone at (208) 496-7737

Materials Simulation

For further information, please contact Bro Nelson at nelsonla@byui.edu
or via phone at (208) 496-7736.

Meteorology

For further information, please contact Bro Turcotte at turcottes@byui.edu
or via phone at (208) 496-7746.

Microwave Scattering

For further information, please contact Bro Lines at linest@byui.edu
or via phone at (208) 496-7740.

Nuclear reaction and reaction network modeling

For further information please contact Bro Kelley at kelleyk@byui.edu
or via phone at (208) 496-7739.

Optics

For further information, please contact Bro Lines at linest@byui.edu
or via phone at (208) 496-7740.

Physics Education Research

For further information, please contact Bro Pyper at pyperb@byui.edu
or via phone at (208) 496-7744.

Positron Annihilation

For further information, please contact Bro Hansen at hansenev@byui.edu
or via phone at (208) 496-7737.

Semi Conductors

For further information, please contact Bro Johnson at johnsonjo@byui.edu
or via phone at (208) 496-7759

Surface Physics/X-Ray Difraction

For further information, please contact Bro Oliphant at oliphantd@byui.edu
or via phone at (208) 496-7743.

Know your Faculty

Jim Croasmun - Croasmunj@byui.edu

Jim Croasmun received his Ph.D. from the University of Idaho in Education, his master's degree from Utah State in Instructional Technology, and his bachelor's degree from BYU in Physics Teaching. He has adjunct taught for the department for 20+ years. His interests include controlled fusion and acoustics

Richard Datwyler - Datwylerr@byui.edu

Richard Datwyler completed his Ph.D. at Utah State University in the field of Plasma physics, specifically computational plasma containment. In conjunction with this he also has interest in atmospheric plasma, kinetic theory of plasma and other computational physics, including solar energy.

Evan Hansen – Department Chair - Hansenev@byui.edu

Evan Hansen received his BS in Physics and graduated with Honors from BYU. He received his MS and PhD in Physics from the University of Illinois at Urbana-Champaign. Prior to coming to BYU-Idaho he spent seven years in research and development in the semiconductor industry.

Richard Hatt – Hattr@byui.edu

Richard Hatt received his BS and Ph.D. in Physics at Brigham Young University. He taught at Southern Oregon University for two years before coming to BYU-Idaho and has taught here since 2002. His interests include Quantum Physics and Solid State Physics.

Joseph Hill –Hilljo@byui.edu

Joseph Hill earned his BS in Physics from BYU-Idaho and a Ph.D in Mechanical Engineering from the University of Arkansas for his work on Directed Self-Assembly Methods in Di-block Co-polymer Thin-Films. His current interest areas span a wide array of topics including, astrophysics, data science, energy storage, fluid dynamics, materials science, micro-electromechanical systems, multi-scale computational modeling, robotics, sustainable energy, and thermodynamics.

Jon Johnson – Johnsonjo@byui.edu

Jon Johnson completed his Ph.D. at the University of Utah and studied materials science, specifically materials for semiconductor devices. Br. Johnson's interests include microscopy (AFM, SEM), acoustics, electronics, and condensed matter physics. As more of a hobby he is interested in optics and photography.

Kevin Kelley – Kelleyk@byui.edu

Kevin Kelley completed his Ph.D. at the University of California-Davis in computational nuclear physics. He has also conducted research in high energy phenomenology and nuclear astrophysics and radiochemistry at Lawrence Livermore National Laboratory.

Todd Lines – Linest@byui.edu

Todd Lines completed a BS in Physics from BYU, and received his MS and PhD in Physics from New Mexico State University. He has worked for the Army Research Laboratory and for several major defense companies. He is currently involved in atmospheric optics research.

Stephen McNeil – McNeils@byui.edu

Stephen McNeil received his Ph.D. from BYU-Provo in Physics and Astronomy. His research dealt with looking for evidence of supermassive black holes at the center of galaxies. Currently he is involved in student research using telescopes at the BYU-Idaho Observatory and is the Planetarium Director. Bro. McNeil is also the advisor for the BYU-Idaho Astronomical Society.

Lance Nelson – Nelsonla@byui.edu

Lance Nelson graduated with his Bachelors from BYU-Idaho, and completed his Ph.D. from BYU with emphasis in computational solid state physics/materials science. He has interests in computational physics, thermodynamics, and energetics of materials.

David Oliphant – Oliphantd@byui.edu

David Oliphant began teaching physics at BYU-Idaho in the fall of 2000. He completed his BS and MS at BYU. He is interested in the way x-rays and electrons interact with matter. He is also interested in computer modeling, particularly in developing methods that can extract more information from the given set of measured data.

Brian Pyper – Pyperb@byui.edu

Brian Pyper is the Director of Physics Education – Advisor and Supervisor of pre-service physics teachers. Bro. Pyper is very active in Physics Education Research and has been a professor at BYU-Idaho since 1999. He received his BS in Physics from BYU, his MS from the University of Utah, and Ph.D. from Utah State University.

Stephen Turcotte – Turcottes@byui.edu

Stephen Turcotte completed his Ph.D. in the area of laser spectroscopy. Before coming to BYU-Idaho, he worked as an optical engineer at Space Dynamics Laboratory in Logan, UT. He has interests in computational physics, protein folding, and weather measurements.

Matt Zachreson – Zachresonm@byui.edu

Matt Zachreson completed his Ph.D. at BYU in plasma physics, with an emphasis on computation and statistical modeling. Prior to joinging the physics faculty, Matt worked for BYU-Idaho's office of Institutional Research and Assessment doing education research, data science, and program evaluation. His interests include making cool graphs (data visualization), using statistics to get further insight into data, and baking.

Degree Opportunities

What Can You Do With a College Degree in Physics?

The answer most appropriate for this question is: anything you want to do. However, while some physics majors go on to become professional physicists, the majority pursue careers in fields where they can put their knowledge to more practical applications. With their skills in problem-solving, mathematical reasoning, computer programming, and organizing and interpreting scientific data, physics grads can move into government and industrial jobs that require an ability to think logically and creatively. Physics majors are well-suited to jobs that require step-by-step problem solving using math skills and good observational and communication skills.

A wide range of industries seeks physics graduates: telecommunications, industrial physics, hospital physics, electronics, computing, quality control testing, banking, insurance, teaching, management, technical sales and the armed forces, for starters. Students who become physicists tend to specialize in one or more areas of physics, such as:

- **Nuclear physics**. Nuclear physics involves the study of the components, structure, and behavior of the nucleus of the atom. It has a number of practical applications in developing nuclear energy, archeological dating, smoke detectors and nuclear medicine. Nuclear diagnostic techniques have revolutionized medicine by providing ways to "see" inside the body without surgery. (Emphasis area(s): Mathematical/Computational)

- **Geophysics**. Geophysicists apply physical theories and measurements to discover the properties of the earth. Geophysics includes the branches of seismology, geothermometry (heating of the earth), hydrology (ground and surface water), and gravity and geodesy (the earth's gravitational field). Some of its applications are used in building highways and bridges, studying earthquakes, urban planning and archaeology. (Emphasis area(s): Geophysics)

- **Atomic, molecular and optical physics.** In this field, physicists study matter and light interactions at the level of the atom. The three are usually grouped together because of their interrelationships, the similarity in methods used, and their related energy scales. Atomic physics is more concerned with the study of the atom than with the forces studied in nuclear physics. Molecular physics focuses on multi-atomic structures and their internal and external interactions with matter and light. Optical physics manipulates light to gain insight into the fundamental properties of light. (Emphasis area(s): Mathematical/Computational/Chemistry)

- **Astronomy**. Astronomy is considered a subfield of physics. Astronomers observe and collect data used to explain relationships between stars and planets as well as other phenomena occurring in the universe. Astronomers, in conjunction with other types of physicists, might be called upon to solve problems connected with space flight navigation and satellite communications. (Emphasis area(s): Astrophysics)

• **Astrophysics**. Astrophysics is the part of astronomy that deals with the physics of stars, star systems and interstellar material. Astrophysicists apply the laws of physics to understand how astronomical bodies are formed, how they interact, and how they die. Astrophysics might be used to figure out how to get to other planets, how to build things in new and safer ways, or to examine how the human body adapts to new situations. (Emphasis area(s): Astrophysics)

• **Space physics.** Space physics is the study of the space environment from the uppermost reaches of the earth's atmosphere to deep space, especially the environment in which satellites must survive. It has important applications as society becomes increasingly dependent on satellites for communication, broadcast, weather monitoring, remote sensing, positional information and military uses. Space exploration has led to the creation of several products such as new types of ceramics, high-performance materials, and even microwave ovens. (Emphasis area(s): Astrophysics)

• **Physics Education**. Physics grads with bachelor's degrees can become elementary or high school teachers. There is almost always a shortage of teachers in the sciences. Technical schools will also hire physics majors who have some professional experience. Public schools require a certification to teach, but not all private schools or technical schools do. (Emphasis area(s): Physics Education)

• **Engineering Physics.** Engineering is another outlet for the physics major. It is one of the most demanding professions, because it often deals with decisions that affect the safety of individuals. Building bridges, skyscrapers, airplanes, and electrical systems requires a solid foundation in physics. Some students will earn a degree in physics and then go on to graduate school for a master's degree in engineering. Others will double-major in physics and engineering. A few other industries that require a solid physics background are construction, chemical, food, aerospace, agriculture, energy, fuel, metallurgy, textiles and clothing, computers and transportation. (Emphasis area(s): Engineering/ Mathematical)

• **Computer Science**. Computer science offers careers for the physics major in graphics and software, artificial intelligence, data processing and computer games. Computer hardware is the result of applied physics. (Emphasis area(s): Computational)

• **Medical Physics**. Medical Physics is the application of physics concepts, theories and methods to medicine or healthcare. Medical Physicists are often found in the following healthcare specialties: medical imaging, nuclear medicine, and radiation oncology. University departments are of two types. The first type are mainly concerned with preparing students for a career as a hospital medical physicist and research focuses on improving the practice of the profession. A second type (increasingly called 'biomedical physics') has a much wider scope and may include research in any applications of physics to medicine from study of biomolecular structure to microscopy and nanomedicine. (Emphasis area(s): Medical)

• **Biophysics**. Biophysics is an interdisciplinary science that applies the approaches and methods of physics to study biological systems. Biophysics covers all scales of biological organization, from molecular to organismic and populations. Biophysical research shares significant overlap with biochemistry, nanotechnology, bioengineering, computational biology and systems biology. (Emphasis area(s): Biophysics/Chemistry/Computational)

A student with an interest in physics and communications might consider telecommunications, television, image analysis, video recording, photography, laser technology, journalism, scientific writing and publishing. Other non-technical careers in which physics majors have found success are law, business administration, sports, marketing and business management.

Besides astronomy, space and earth science careers for physics majors include space technology, atmospheric sciences, energy and resources and ocean sciences. Openings in environmental sciences and physics would include positions studying noise control, pollution control, conservation, radiation protection, and environmental monitoring.

Despite the important and intriguing specialties available to physicists, the vast majority of physics majors enter other professions. They may teach high school physics, perform research and development in private industry or in government labs, or lend their expertise to medical imaging, scientific book publishing, and scientific reporting. Physics careers can come from unexpected places. Insurance companies, for example, hire physicists to study the performances of the products they insure and make recommendations for reducing injuries and property loss.

A graduate with a master's degree in physics can do most of the above jobs but usually with a higher degree of responsibility and pay. They also have the opportunity to teach at community colleges. A PhD holder is more likely to become a university professor or researcher. Industries will also hire PhDs to oversee research projects for their companies and design new scientific instruments.

Skills, Interests and Qualities

To be a physicist you should have:

- good scientific and mathematical knowledge
- an enquiring mind
- clear and logical thinking, with good problem solving skills
- a methodical approach to work, with a high level of accuracy
- good communication and presentation skills
- report writing skills
- the ability to work both as part of a team and on your own
- team leadership and project management skills
- a good understanding of statistics and relevant computer packages
- a willingness to work flexibly and adapt to change.

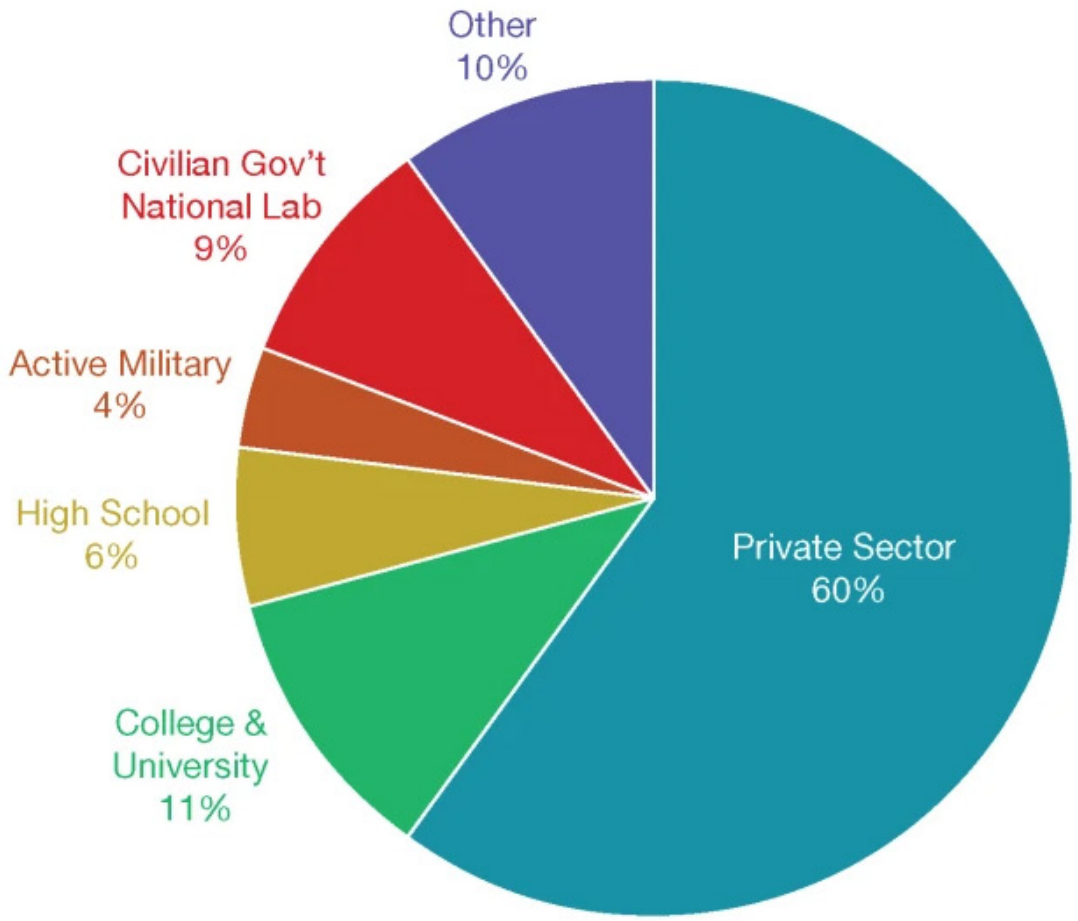
How Much Can You Make With a College Degree in Physics?

The salary you can make with a physics degree varies with the level of education (bachelors, master, PH.D) and location. However, the following are the latest statistics from https://www.aip.org/statistics.

AIP PHYSICS TRENDS

Spring 2024

Where New Physics Bachelors Work



Source: AIP Physics Bachelor's Follow-up Survey, classes of 2021 and 2022 combined.

@AIP_Stats

aip.org/statistics

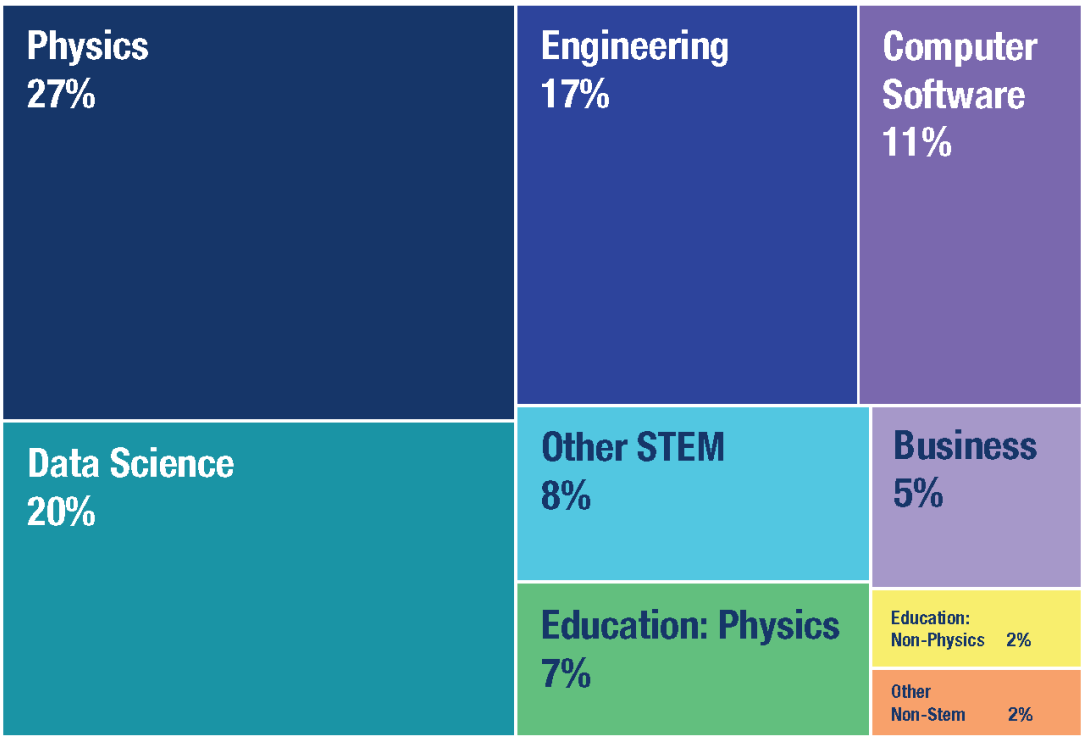
Where New Physics Bachelors Work

Common Job Titles for New Physics Bachelors

AIP PHYSICS TRENDS

Spring 2026

Field of Employment for New Physics PhDs



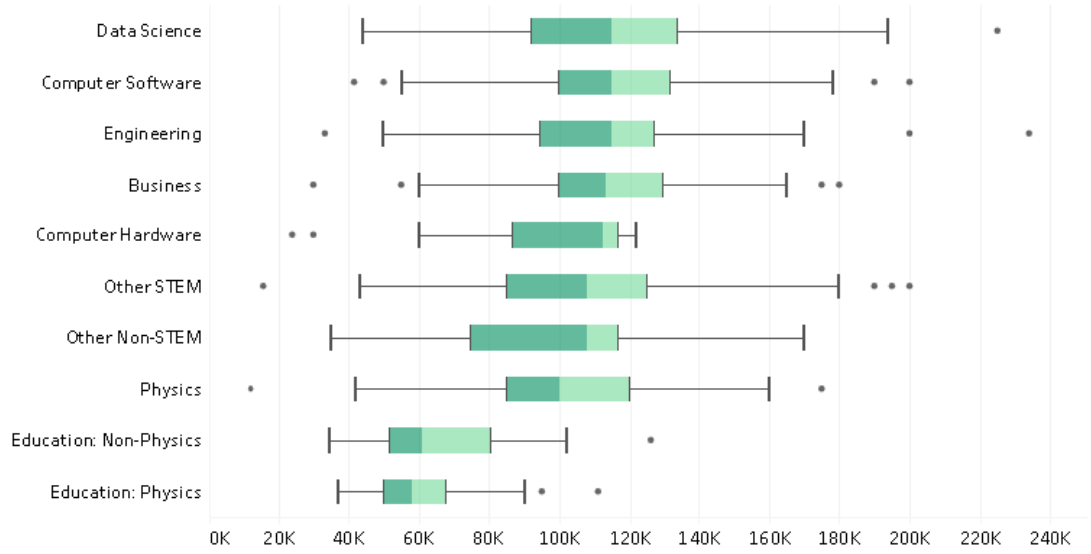
(Employed in potentially permanent positions, academic years 2019-20 through 2023-24)

Who's Hiring Physics PhDs

Scan the QR code to view listings of employers that recently hired new PhDs by their primary field of employment. Also see starting salaries, job titles and more.

https://www.aip.org/statistics/whos-hiring-physics-phds

Starting Salary Ranges by Field of Employment:



The boxes in the salary figure represents the middle 50% of salaries. The full salary range is represented by the lines extending to either side. The dots represent statistical outliers.

All Fields Employers:

3M Company
1910 Genetics
Ab Initio Software
Academy Of The Sacred Heart
Aecom
Aetna
Afiniti
Air Force Research Laboratory
Airbnb
Allen Institute
Alliance Data Systems
Alliancebernstein
Allstate
Amazon

All Fields Job Titles:

Academic Laser Scientist
Adjunct Professor Of Physics
Aeronautical Engineer
Ai Research Consultant
Algorithm Developer
Algorithmic Trader
Amo Physicist
Analyst
Analyst/Programmer
Analyst, Baseball Analytics
Analytic Scientist
Analytic Scientist II
Analytic Software-Scientist II

Initial Employment Sectors of New Physics Bachelors, Academic Years 2022-23 and 2023-24