2012-13

Physics Major Programs

Physics is concerned with the most basic principles that underlie all phenomena in the universe. Physicists ask, "How does the world work?" They search for the most elementary particles; they seek understanding of the behavior of collections of particles ranging from quarks in nuclei and electrons in atoms to stars in galaxies; they strive for insights into the nature of space and time, and they explore the behavior of matter and energy. On a more human scale, physicists study an enormous range of topics including all the devices of modern electronics, complex biological molecules, the atmosphere, and all forms of energy and its uses. Physics is the basis for much of engineering and technology. Studying physics prepares some students to push back the boundaries of knowledge in this most fundamental of the natural sciences. For others it provides training in the concepts and methods of science for application in many professional areas, and for many it gives a more substantial basis for understanding many aspects of modern society.

The Physics undergraduate major is planned to serve students with a broad spectrum of interests and objectives. The department offers both Bachelor of Arts (BA) and Bachelor of Science (BS) degrees. In addition, there is a joint Astronomy/Physics BA. The basic BA is designed for students interested in physics and planning to enter professional schools in business, education, law, and medicine, and for liberal arts students desiring a strong background in physical science but with career objectives in other areas. Students planning graduate study in physics or physics related areas or preparing to enter jobs in a scientific or technical field should elect the BS or the BA with a Distinguished Major course sequence, or for astronomy or astrophysics, the Astronomy/Physics BA. These programs provide intensive preparation in physics.

If you are curious about how a physics major may fit your interests, please contact one of the physics undergraduate advisers listed below to learn about the various possibilities and to design a program to fit your specific needs. Extensive information about the department and its programs can be found through the Physics Department site on the Internet at the address given below.

Physics Office: Room 101, Jesse Beams Laboratory Physics
Mailing Address: Physics Department, University of Virginia, 382 McCormick Road, PO Box 400714, Charlottesville, VA 22904 - 4714
Phone: 434-924-3781
Fax: 434-924-4576
Internet Address: http://www.phys.virginia.edu

Undergraduate Advisors	Office	Office Phone	Email Address
Blaine Norum	136 Physics	924-6789	ben@virginia.edu
Stefan Baessler	169 Physics	243-1024	sfb5d@virginia.edu
P. Q. Hung	311B Physics	924-6819	pqh@virginia.edu
Dinko Počanić	165 Physics	924-7691	dp5m@virginia.edu
Steven Thornton	305 Physics	924-6808	stt@virginia.edu
Diana Vaman	318 Physics	924-6585	dv3h@virginia.edu

In the sections that follow we give some information about the department and its activities, describe the requirements for the various degrees, and show some typical course sequences leading to the degrees.

The Physics Major

There are several introductory course sequences leading to the physics major. For all of them it is highly desirable to complete Math 1310, 1320 or equivalent courses in calculus by the end of the first year. If calculus is not taken during the first year, any of the sequences can be started in the second year and the requirements for the BA, but not the BS, completed in four years.

Requirements for the BA in Physics

The principal mathematics sequence consists of four courses. Recognizing that each year several students in the School of Engineering and Applied Sciences elect to declare a second major in Physics, we allow the following substitutions:

Calculus I	APMA 1090	for MATH 1310
Calculus II	APMA 1110	for MATH 1320
Calculus III	APMA 2120	for MATH 2310
Differential Equations	APMA 2130	for MATH 3255

We also allow the following substitutions for Elementary Lab courses:

Basic Lab I	PHYS 2030	for PHYS 1429
Basic Lab II	PHYS 2040	for PHYS 2419

There are two options leading to the BA in physics, each having three components:

<u>Option I</u>

(1) Prerequisites - MATH 1310, 1320 and PHYS 1610, 1620.
(2) MATH 2310, 3255 and PHYS 2610, 2620, 2630, 2640.
(3) Three courses chosen from PHYS 2660 and/or 3000-level physics courses.

<u>Option II</u>

(1) Prerequisites –MATH 1310, 1320
(2) MATH 2310, 3255 and PHYS 1425, 1429, 2415, 2419, 2620
(3) Four courses chosen from PHYS 2660 and/or 3000-level physics courses
This option is particularly appropriate for Engineering students desiring an additional major in physics.

For either of the options, a year of chemistry may be substituted for one of the 3000-level Physics courses in (3).

Students choosing Option II who want more extensive preparation in basic physics, particularly those planning to take Physics courses numbered 3150 and higher, should replace PHYS 1429, 2419 in component (2) with the higher level laboratory sequence PHYS 2630, 2640 to be taken after completing PHYS 1425, 2415.

For students electing a basic BA program, the courses, PHYS 3110, 3120 - Widely Applied Physics, if elected in component (3), can be used to complete a strong preparation in basic Physics. These courses are designed to make use of the concepts learned in the introductory courses to understand some modern applications with a focus on energy production and use. Either one (for Option I) or two (for Option II)

additional courses complete the requirements of component (3). PHYS 2660 Fundamentals of Scientific Computing and a year of introductory chemistry are good choices for completing this component. Students completing the basic BA program have an outstanding record of success in admission to medical, law, business, and education schools.

Strong preparation for graduate study in Physics and Physics-related areas and for scientific and technical jobs is provided by the following programs:

BA with Distinguished Major Course Sequence: This sequence may be entered using components (1) and (2) of Options I or II above. Component (3) is replaced by the following requirements: PHYS 2660, 3170 or 3180, 3210, 3310, 3420, 3650, 3660, 3995 and one 3000-5000 level Physics elective. If Option II is used, substitution of PHYS 2630, 2640 for PHYS 1429, 2419 is strongly recommended.

BS in Physics: The requirements for the BS in Physics are the completion of the Distinguished Major Course sequence plus MATH 5210, 5220 (or equivalent APMA courses) and PHYS 3430.

Three special concentrations can be pursued by students in either the BA or the BS programs: A Computational Physics Concentration (PHYS 5630, 5640 Computational Physics I, II); an Optics Concentration (PHYS 5310 Optics and PHYS 5320 Fundamentals of Photonics); and an Experimental Physics Concentration (PHYS 3150 Electronics, PHYS 3170 Intermediate Laboratory I, and PHYS 3180 Intermediate Laboratory II).

A grade point average of at least 2.0 for all the required courses with a minimum grade of C- must be achieved for graduation as a Physics major.

BA in Astronomy-Physics: This is an interdepartmental major administered jointly with the Astronomy Department. This major prepares a student for graduate study in either astronomy or Physics. The requirements are MATH 1310, 1320, 2310, 3255, 5210, 5220; PHYS 1610, 1620, 2610, 2620, 2630, 2640, 2660, 3210, 3420, 3430, 3650; and ASTR 2110, 2120, 3130, 4993, 4998 (Senior Thesis), and six additional credits of 3000-5000 level Astronomy courses.

Except for Echols scholars, the requirements for the Physics and Astronomy-Physics degrees include completion of the standard College of Arts and Sciences competency and area requirements.

The course requirements for the BA, BA-DMP and BS are summarized in Tables I & II on pages 6 and 7, which also show the topics and credit hours. The BA Astronomy-Physics requirements are summarized on page 15.

Some Information about the Physics Program

Physics majors are a very outstanding, enthusiastic and diverse group. During the last decade an average of 35 students has graduated each year with bachelor's degrees in Physics. An encouraging trend is that 24% of them are women. There is a wide diversity of interests, and many students have double majors. In the last several years second majors have included anthropology, biology, chemistry, economics, English, environmental science, French, German language and literature, government, history, mathematics, music, philosophy, psychology, religious studies, Slavic languages and literature, and studio art.

Approximately half of our BS Physics and BA Astronomy-Physics majors go on to graduate or professional schools, most at top-ranked universities, and they are very successful there. Recent graduates have attended

the University of California at Berkeley, University of California at Santa Barbara, Cal Tech, Chicago, Colorado, Cornell, Dartmouth, Duke, Georgia Tech, Harvard, Johns Hopkins, MIT, Princeton, Stanford and Yale. Many recent graduates have taken scientific or technical positions in industry or government immediately after graduating with a bachelor's degree. Each year several go to professional schools in medicine, education, business and law. Others graduate with Physics as a concentration in a broad liberal arts program and enter a variety of careers.

Beginning the first year there are special courses for Physics majors. The third and fourth year classes are small, and students have much interaction with faculty members. Since the Department has active research programs in all the major fields of Physics that involve all 35 faculty members, there are many opportunities for undergraduates to participate in research on the frontiers of Physics. Students are encouraged to participate in research starting in the summer following their second year. During their third or fourth years, students in the Distinguished Majors and BS programs undertake research projects (PHYS 3995), working on a tutorial basis with a faculty member and often working with a research group. The study culminates in a written and an oral report. Students find these projects among the most valuable and enjoyable parts of their programs. Also there are summer jobs and part-time jobs during the academic year with the various research groups. An Intermediate Lab course (PHYS 3170 or 3180) is often taken after a student has begun doing research in order to provide exposure to a broader range of experimental techniques.

In addition to the undergraduate courses, many graduate courses in Physics may be taken by advanced undergraduates. Undergraduate students are encouraged to take advantage of the weekly colloquia. These talks are given by eminent physicists from around the world. They provide further contact with research on the frontiers of Physics.

All Physics majors are expected to become proficient in the use of computers by taking courses and by using computers for coursework and in the research labs. PHYS 2660 Fundamentals of Scientific Computing introduces some programming concepts and numerical methods. We provide an introduction to data acquisition and analysis in the introductory laboratory courses, an introduction to microprocessors in PHYS 3150 - Electronics, more advanced data acquisition and analysis in the intermediate Physics laboratory courses, and many class and laboratory exercises requiring use of computers. As mentioned above, there are courses providing a concentration in computational Physics. In addition a wide variety of computer courses is available through the Computer Science Department and numerous workshops are presented by Information Technology and Communication staff.

Personal computers and computer systems are widely available. A departmental computer facility is open to all majors, and there are computers in the undergraduate labs, as well as in research labs in which students participate. All are linked through local networks and to national and worldwide networks.

Early declaration of major is encouraged: you do not have to wait until your fourth semester. A valued prerequisite for Physics majors is that all are provided keys to the Physics Building that give them access at any time to the Physics Library, two conference rooms, and the departmental computer facility. Very frequently at night and on weekends one finds groups of Physics majors gathered in one of the conference rooms or the library, working together (as we encourage them to do) on quantum mechanics, statistical Physics, or other topics.

Some very interesting facts about the skills Physics graduates find most useful emerged from a recent survey by the American Institute of Physics. They queried some thousands of people with Physics degrees (bachelor's, master's, and doctoral) working in industry, government, and secondary and higher education about the skills they used most frequently. At all degree levels and for all types of jobs, whether directly involving physics or not, almost 100% of respondents said that problem solving is their most frequently used

skill. Computer skills were highly ranked by most of the respondents, but even more highly ranked were interpersonal skills and technical writing. These same skills have been identified as most important by many companies who hire physics graduates.

We address the development of these skills explicitly in the physics major. Problem solving and computing are already strong components of the program. The upper-level Physics laboratories and independent study courses are structured to provide excellent opportunities for developing skills in both oral and written communication of technical material. Spontaneous teamwork on solving problems in the upper-level courses has long been a part of being a physics major. Working with a variety of partners in the elementary and upper-level lab courses also helps develop skills in interpersonal relationships. These experiences are supplemented in physics classes by group problem solving, which has been shown to be an effective way of learning new concepts and has the added effect of teaching and encouraging teamwork.

The Society of Physics Students (SPS) and the Sigma Pi Sigma Physics honor society provide very valuable support for the Physics major program. The weekly SPS meetings offer special talks on topics related to physics by faculty members from physics and other departments at the University. There are also presentations devoted to giving advice and commentary on graduate and professional schools, and talks about careers in science. At each meeting there is pizza and time for students to talk to each other and to faculty members who are invited to attend. Membership in SPS is open to any student interested in Physics. Membership in Sigma Pi Sigma recognizes special academic achievement.

There are a number of activities each year intended to help students and faculty get to know each other and to recognize academic achievement. There is an annual reception in the Colonnade Club near the beginning of the fall semester to which all undergraduate majors, students who think they might like to major, and all physics faculty are invited. During this ceremony an award is presented to the graduate with the most outstanding academic record in physics.

Distinguished Major Program - This program provides recognition of outstanding academic performance in a challenging sequence of Physics courses including a research project. Students who complete the Distinguished Majors Course Sequence or the BS requirements with final grade point averages exceeding 3.4, 3.6, or 3.8, are given departmental recommendation to receive their degrees (BA or BS) with distinction, high distinction, or highest distinction, respectively.

Career Planning - In addition to the extensive resources available through University Career Services (UCS), the Physics Department offers assistance with career planning in a number of ways:

Discussions with undergraduate advisors and other Physics faculty members
Talks about graduate schools and careers at SPS meetings
A brochure, “What can I do with a Physics major?”
Contacts with UVa alumni who are willing to offer career information
Pointers to information on the Internet:
UCS web site, http://www.virginia.edu/~career/
The American Institute of Physics site, http://aip.org/

Table I - Requirements for BA in Physics

Option I		Option II	
Prerequisites		Prerequisites	
MATH 1310 Calculus I	[4]	MATH 1310 Calc. I	[4]
PHYS 1610 Intro. Phys. I	[4]	MATH 1320 Calc. II	[4]
MATH 1320 Calculus II	[4]	Requirements	
PHYS 1620 Intro. Phys. II	[4]	MATH 2310 Calc. III	[4]
		MATH 3255 Differential Eqn.	[4]
Requirements		PHYS 1425 Gen. Phys. I	[3]
MATH 2310 Calculus III	[4]	PHYS 1429 Gen. Phys. Lab I	[1]
MATH 3255 Differential Eqn.	[4]		
PHYS 2610 Intro. Phys. III	[4]	PHYS 2415 Gen. Phys. II	[3]
PHYS 2630 Elem. Lab I	[3]	PHYS 2419 Gen. Phys. Lab II	[1]
PHYS 2620 Modern Physics	[4]	PHYS 2620 Modern Physics	[4]
PHYS 2640 Elem. Lab II	[3]		
Three courses chosen from PHYS 2660 and /or 3000-level physics courses		Four courses chosen from PHYS 2660 and /or 3000-level physics courses	

For either option, one elective Physics course can be replaced by a year of chemistry.
Note also the allowed Mathematics and Laboratory substitutions listed on page 2.

Students choosing Option II who want more extensive preparation in basic Physics and particularly those planning to take Physics courses numbered 3150 and higher, should replace PHYS 1429, 2419 with the higher level laboratory sequence PHYS 2630, 2640 to be taken after completing PHYS 1425 & 2415 or completing PHYS 1425 and taking PHYS 2630 concurrently with PHYS 2415.

3000-level courses from which to select

PHYS 3040	Physics of the Human Body	[3]
PHYS 3110	Widely Applied Physics	[3]
PHYS 3120	Applied Physics: Energy	[3]
PHYS 3150	Electronics	[3]
PHYS 3170	Intermediate Lab I	[3]
PHYS 3180	Intermediate Lab II	[3]
PHYS 3190	Advanced Lab	[3]
PHYS 3250	Applied Nuclear Physics	[3]
PHYS 3995	Research	[3]

Except for 3995 and 3250, courses numbered 3210 and higher require MATH 3255 Differential Equations as prerequisite.

PHYS 3210	Mechanics	[3]
PHYS 3310	Statistical Physics	[3]
PHYS 3420, 3430	Electricity and Magnetism I, II	[3,3]
PHYS 3650, 3660	Quantum Mechanics I, II	[3,3]

Table II - Requirements for BA-Distinguished Major and BS in Physics

Prerequisites

Option I		Option II	
MATH 1310 Calculus I	[4]	MATH 1310 Calc. I	[4]
PHYS 1610 Intro. Phys. I	[4]	MATH 1320 Calc. II	[4]
MATH 1320 Calculus II	[4]	MATH 2310 Calc. III	[4]
PHYS 1620 Intro. Phys. II	[4]	PHYS 1425 Gen. Phys. I	[3]
		*PHYS 1429 Gen. Phys. Lab I	[1]
MATH 2310 Calculus III	[4]	MATH 3255 Differential Eqn.	[4]
PHYS 2610 Intro. Phys. III	[4]	PHYS 2415 Gen. Phys. II	[3]
PHYS 2630 Elem. Lab I	[3]	*PHYS 2419 Gen. Phys. Lab II	[1]
MATH 3255 Differential Eqn.	[4]		
PHYS 2620 Modern Physics	[4]	PHYS 2620 Modern Physics	[4]
PHYS 2640 Elem. Lab II	[3]		

Required Courses

BA -Distinguished Major		BS	
PHYS 2660 Fund. Scientific Computing	[3]	PHYS 2660 Fund. Scientific Computing	[3]
PHYS 3170 or 3180 Intermediate Lab	[3]	PHYS 3170 or 3180 Intermediate Lab	[3]
PHYS 3210 Mechanics	[3]	PHYS 3210 Mechanics	[3]
PHYS 3420 Electricity & Magnetism I	[3]	PHYS 3420 Electricity & Magnetism I	[3]
PHYS 3310 Statistical Physics	[3]	PHYS 3310 Statistical Physics	[3]
PHYS 3650, 3660 Quantum Physics I, II	[3,3]	PHYS 3650, 3660 Quantum Physics I, II	[3,3]
PHYS 3995 Research	[3]	PHYS 3995 Research	[3]
Physics Elective**		Physics Elective**	[3]
		PHYS 3430 Electricity & Magnetism II	[3]
		MATH 5210 Advanced Calculus	[3]
		MATH 5220 Partial Differential Equations	[3]

*For BA-DMP and BS programs, replacement of PHYS 1429, 2419 with PHYS 2630, 2640 is strongly recommended.

**To be chosen from any of the 3000-level or 5000-level Physics courses.

Typical Course Sequences and Upper-level Course List

Information contained on the following pages shows:

A. Examples of Course Sequences leading to the various degrees

BA - Basic Program
BA including Premedical Requirements via PHYS 1610
BA including Premedical Requirements via PHYS 1425
BA for Engineering Students
BA with Distinguished Major Course Sequence
BS in Physics
BA in Astronomy/Physics - Requirements and usual course sequence

B. List of Upper Level Physics Courses

BA in Physics - Basic Program

Example Course Sequence for Option I

Fall			Spring		
First Year					
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
PHYS 1610	Intro. Physics I	[4]	PHYS 1620	Intro. Physics II	[4]
---			---		
---			---		
---			---		
Second Year					
MATH 2310	Calculus III	[4]	MATH 3255	Differential Eqn.	[4]
PHYS 2610	Intro. Physics III	[4]	PHYS 2660	Fund. Scien. Computing	[3]
---			PHYS 2620	Modern Physics	[4]
---			---		
---			---		
Third Year					
PHYS 2630	Elem. Lab I	[3]	PHYS 2640	Elem. Lab II	[3]
---			---		
---			---		
---			---		
---			---		
Fourth Year					
PHYS 3110	Widely Applied Physics	[3]	PHYS 3120	Applied Physics: Energy	[3]
---			---		
---			---		
---			---		
---			---		

Note that this program can be started in the second year, and completed by moving PHYS 2630, 2640 to the fourth year.

If Option II is chosen, the four-semester introductory sequence, PHYS 1610, 1620, 2610, 2620 and PHYS 2630, 2640 Elem. Lab are replaced by PHYS 1425, 2415, 2620 and PHYS 1429, 2419 Physics Lab taken in the second or third year as preparation for the upper level physics courses. Students choosing Option II who want more extensive preparation in basic physics and particularly those planning to take physics courses numbered 3150 and higher should replace PHYS 1429, 2419 in Component (2) with the higher level laboratory sequence PHYS 2630, 2640 to be taken after completing PHYS 1425, 2415.

BA in Physics - Basic Program

Example Course Sequence for Option II

Fall		Spring	
First Year			
MATH 1310 Calc. I	[4]	MATH 1320 Calc. II	[4]
----------		PHYS 1425 General Physics I	[3]
----------		PHYS 1429 General Physics Lab I	[1]
----------		----------	
----------		----------	
Second Year			
MATH 2310 Calc. III	[4]	MATH 3255 Differential Eqn.	[4]
PHYS 2415 General Physics II	[3]	PHYS 2620 Modern Physics	[4]
PHYS 2419 General Physics Lab II	[1]	----------	
----------		----------	
----------		----------	
Third Year			
PHYS 3110 Widely Applied Physics	[3]	PHYS 3120 Applied Physics: Energy	[3]
----------		----------	
----------		----------	
----------		----------	
----------		----------	
Fourth Year			
PHYS 3xxx	[3]	PHYS 3xxx	[3]
----------		----------	
----------		----------	
----------		----------	
----------		----------	

Students choosing Option II who want more extensive preparation in basic physics and particularly those planning to take physics courses numbered 3150 and higher should replace PHYS 1429, 2419 with the higher level laboratory sequence PHYS 2630, 2640, which can be taken along with PHYS 2415 and PHYS 2620, respectively.

Physics BA - Premed I

Example Course Sequence for Option I including Premed Requirements

Fall			Spring		
First Year					
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
CHEM 1410	Intro. Chem. I	[3]	CHEM 1420	Intro. Chem. II	[3]
CHEM 1411	Intro. Chem. Lab I	[2]	CHEM 1421	Intro. Chem. Lab II	[2]
---			---		
---			---		
Second Year					
MATH 2310	Calculus III	[4]	MATH 3255	Differential Eqn.	[4]
PHYS 1610	Intro. PHYS. I	[4]	PHYS 1620	Intro. PHYS II	[4]
BIO 2010	Intro. BIO. I	[3]	BIO 2020	Intro. BIO. II	[3]
BIO 2030	Intro. BIO. Lab I	[2]	BIO 2040	Intro. BIO. Lab II	[2]
---			---		
Third Year					
PHYS 2610	Intro. PHYS. III	[4]	PHYS 2620	Intro. PHYS. IV	[4]
PHYS 2630	Elem. Lab I	[3]	PHYS 2640	Elem. Lab II	[3]
CHEM 2410	Organic Chem. I	[3]	CHEM 2420	Organic Chem. II	[3]
CHEM 2411	Organic Lab I	[3]	CHEM 2421	Organic Lab II	[3]
---			---		
Fourth Year					
PHYS 3110	Widely Applied Physics	[3]	PHYS 3040	Phys. of the Human Body	[4]
---			---		
---			---		
---			---		
---			---		

Physics BA - Premed II

Example Course Sequence for Option II including Premed Requirements

Fall			Spring		
First Year					
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
CHEM 1410	Intro. Chem. I	[3]	CHEM 1420	Intro. Chem. II	[3]
CHEM 1411	Intro. Chem. Lab I	[2]	CHEM 1421	Intro. Chem. Lab II	[2]
---			---		
---			---		
Second Year					
MATH 2310	Calculus III	[4]	MATH 3255	Differential Eqn.	[4]
PHYS 1425	Physics I	[4]	PHYS 2415	Physics II	[4]
PHYS 1429	Physics Lab I	[1]	PHYS 2419	Physics Lab II	[1]
BIO 2010	Intro. Bio. I	[3]	BIO 2020	Intro. Bio. II	[3]
BIO 2030	Intro. Bio. Lab I	[2]	BIO 2040	Intro. Bio. Lab II	[2]
Third Year					
---			PHYS 2620	Modern Physics	[4]
CHEM 2410	Organic Chem. I	[3]	CHEM 2420	Organic Chem. II	[3]
CHEM 2411	Organic Lab I	[3]	CHEM 2421	Organic Lab II	[3]
---			---		
---			---		
Fourth Year					
PHYS 3110	Widely Applied Physics	[3]	PHYS 3120	Applied Physics: Energy	[3]
---			PHYS 3040	Physics of Human Body	[3]
---			---		
---			---		
---			---		

Students choosing Option II who want more extensive preparation in basic physics and particularly those planning to take physics courses numbered 3150 and higher should replace PHYS 1429, 2419 in component (2) with the higher level laboratory sequence PHYS 2630, 2640 to be taken after completing PHYS 1425, 2415.

BA in Physics - Distinguished Major

Usual Course Sequence

Fall			Spring		
First Year					
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
PHYS 1610	Intro. Phys. I	[4]	PHYS 1620	Intro. Phys. II	[4]
---			PHYS 2660	Fund. Scien. Computing	[3]
---			---		
---			---		
Second Year					
MATH 2310	Calculus III	[4]	MATH 3255	Differential Eqn.	[4]
PHYS 2610	Intro. Phys. III	[4]	PHYS 2620	Modern Physics	[4]
PHYS 2630	Elem. Lab I	[3]	PHYS 2640	Elem. Lab II	[3]
---			---		
---			---		
Third Year					
PHYS 3210	Mechanics	[3]	PHYS 3420	Electricity & Magnetism I	[3]
PHYS 3650	Quantum Physics I	[3]	PHYS 3660	Quantum Physics II	[3]
---			---		
---			---		
---			---		
Fourth Year					
PHYS 3995	Research	[3]	PHYS 3180	Intermediate Lab	[3]
PHYS 3310	Statistical Physics	[3]	Physics 3000-5000-level elective		[3]
---			---		
---			---		
---			---		

Although the introductory sequence, PHYS 1610, 1620, 2610, is strongly recommended, it can be replaced by PHYS 1425, 2415 taken in the second year as preparation for the upper level physics courses.

BS in Physics

Usual Course Sequence

First Year

Fall			Spring		
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
PHYS 1610	Intro. Phys. I	[4]	PHYS 1620	Intro. Phys. II	[4]
---			PHYS 2660	Fund. Scien. Computing	[3]
---			---		
---			---		

Second Year

MATH 2310	Calculus III	[4]	MATH 3255	Differential Eqn.	[4]
PHYS 2610	Intro. Phys. III	[4]	PHYS 2620	Modern Physics	[4]
PHYS 2630	Elem. Lab I	[3]	PHYS 2640	Elem. Lab II	[3]
---			---		
---			---		

Third Year

MATH 5210	Advanced Calculus	[3]	MATH 5220	Partial Diff. Eqn.	[3]
PHYS 3210	Mechanics	[3]	PHYS 3420	Electricity & Magnetism I	[3]
PHYS 3650	Quantum Physics I	[3]	PHYS 3660	Quantum Physics II	[3]
---			---		
---			---		

Fourth Year

PHYS 3995	Research	[3]	PHYS 3180	Intermediate Lab.	[3]
PHYS 3430	Electricity & Magnetism II	[3]	Physics 3000-5000 level elective		[3]
PHYS 3310	Statistical Physics	[3]	---		
---			---		
---			---		

Although the introductory sequence, PHYS 1610, 1620, 2610, is strongly recommended, it can be replaced by PHYS 1425, 2415 as preparation for the upper level Physics courses. Students choosing this option should meet with a Physics major adviser to work out a schedule including PHYS 2620, the introductory labs and the upper level courses.

BA Astronomy/Physics

Usual Course Sequence

First Year

Fall			Spring		
MATH 1310	Calculus I	[4]	MATH 1320	Calculus I	[4]
PHYS 1610	Intro. Phys. I	[4]	PHYS 1620	Intro. Phys. II	[4]
Language 1010		[4]	Language 1020		[4]
*ENWR 1505		[3]	PHYS 2660	Fund. Scientific Computing	[3]
**Elective		---	**Elective		---

Second Year

+ASTRO 2110	Gen. Astro. I	[3]	+ASTRO 2120	Gen. Astro. II	[3]
MATH 2310	Calculus III	[4]	MATH 3255	Differential Eqn.	[4]
PHYS 2610	Intro. Phys. III	[4]	PHYS 2620	Modern Physics	[4]
PHYS 2630	Elem. Lab I	[3]	PHYS 2640	Elem. Lab II	[3]
Language 2010		[3]	Language 2020		[3]

Third Year

ASTRO 3130	Obser. Astro.	[3]	ASTRO 4993	Tutorial	[3]
PHYS 3210	Mechanics	[3]	PHYS 3420	Electricity & Magnetism I	[3]
PHYS 3650	Quantum Phys. I	[3]	MATH 5220	Partial Diff. Eqn.	[3]
MATH 5210	Adv. Calculus	[3]	**Electives		---
**Elective		---			

Fourth Year

+3000-5000	Level Astro	[3]	ASTRO 4810	Intro. ASTROPHYS.	[3]
PHYS 3310	Statistical Phys.	[3]	(or 3000-5000 level Astro)		
PHYS 3430	Electricity & Magnetism II	[3]	ASTRO 4998	Thesis	[3]
Electives		---	Electives		---

TOTAL HOURS REQUIRED [123]

*Unless excused.

**The electives in the first three years should be chosen to meet the general BA degree requirements for the College of Arts and Sciences.

+May be taken in first year with permission of instructor.

Distinguished Major To qualify for a distinguished major in Astronomy/PHYS:

a) take
1) ASTRO 4998 (senior thesis) for two semesters
2) ASTRO 4810 (Intro. to Astrophys.) as 4th year elective
3) One graduate-level (5000 or above) Astronomy course as 4th year elective
4) PHYS 3660 (Quantum Phys. II)

b) maintain a GPA above 3.4 (Distinction), above 3.6 (High Distinction), above 3.8 (Highest Distinction)

Upper Level Physics Courses

PHYS 3040	Physics of the Human Body	[3]
PHYS 3110	Widely Applied Physics	[3]
PHYS 3120	Applied Physics: Energy	[3]
PHYS 3150	Electronics	[3]
PHYS 3170, 3180	Intermediate Lab	[3, 3]
PHYS 3190	Advanced Lab	[3]
PHYS 3210	Mechanics	[3]
PHYS 3250	Applied Nuclear Physics	[3]
PHYS 3310	Statistical Physics	[3]
PHYS 3420, 3430	Electricity and Magnetism I, II	[3, 3]
PHYS 3650, 3660	Quantum Theory I, II	[3, 3]
PHYS 3810, 3820	Topics in Physics Related Research Areas	[3, 3]
PHYS 3993	Independent Study	[3]
PHYS 3995	Research	[3]
PHYS 5110, 5120	Selected Topics in Classical and Modern Physics	[3, 3]
PHYS 5190	Electronics	[3]
PHYS 5210	Mechanics	[3]
PHYS 5240	Introduction to General Relativity	[3]
PHYS 5250, 5260	Mathematical Methods of Physics I, II	[3, 3]
PHYS 5310	Optics	[3]
PHYS 5320	Fundamentals of Photonics	[3]
PHYS 5620	Introduction to Solid State Physics	[3]
PHYS 5630, 5640	Computational Physics I, II	[3, 3]
PHYS 5720	Introduction to Nuclear and Particle Physics	[3]
PHYS 5820	Introduction to Nanophysics	[3]