Undergraduate Physics Degree Programs (2021-22)

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.

Figure 1: The QR code will bring you to a pdf version of this document

The Major Program in Physics 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, we and the Astronomy department offer the joint Astronomy/Physics BS. The 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 for a specialization in astronomy or astrophysics, the Astronomy/Physics BS. These programs provide intensive preparation in physics.

The Minor Program in Physics is intended mainly for students with a strong interest in the subject who do not have the time to commit to the mathematics and physics course load required for the major.

If you are curious about how a physics degree 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. No prerequisite classes have to be taken before a Physics Major or Minor is declared.

Undergraduate Advisors	Office	Office Phone	Email Address
Stefan Baeßler	Physics 169	243-1024	baessler@virginia.edu
Gia-Wei Chern	Physics 310C	924-4276	gc6u@virginia.edu
Nilanga Liyanage	Physics 321	924-6596	nl8n@virginia.edu
Olivier Pfister	Physics 305	924-7956	op6n@virginia.edu
Cass Sackett	PLSB 104	924-6795	cas8m@virginia.edu
Diana Vaman	Physics 308	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.

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Some Information about the Physics Program

Physics majors are a very outstanding, enthusiastic and diverse group. During the last years, an average of 50 students has graduated each year with bachelor's degrees in Physics. There is a wide diversity of interests, and many students have double majors. 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 BS 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, Cornell, Princeton, Duke, Georgia Tech, Harvard, Toronto, Johns Hopkins, Michigan, MIT, 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 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 at the latest. Students in 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 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.

In addition to the undergraduate courses, many graduate courses in Physics are regularly 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. Fundamentals of Scientific Computing (PHYS 2660) introduces some programming concepts and numerical methods. We provide an introduction to data acquisition and analysis in the introductory laboratory courses, an Electronics lab (PHYS 3150), more advanced data acquisition and analysis in the Intermediate and Advanced Laboratory courses. 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 Information Technology Services staff that presents numerous workshops.

Early declaration of major is encouraged: you do not have to wait until your fourth semester. A valued perk for Physics majors is that all are provided keys to the Physics Building that give them access at any time to the Physics Library, and two conference rooms. 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 research 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 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 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.

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
- UCS web site, http://career.virginia.edu/
- The American Institute of Physics site, http://aip.org/

REQUIREMENTS: BACHELOR OF ARTS (BA) IN PHYSICS

The basic BA is designed for students interested in physics and planning to enter professional schools in business, law, and medicine, and for liberal arts students desiring a strong physics background, but with career objectives in other areas.

The following requirements are for students who took their introductory physics courses 2021/22 or later. There are three groups of courses that are needed for the BA degree:

(1) Prerequisites – MATH 2310[1] and PHYS 1420, 1429, 2410, 2419
(2) MATH 3250 and PHYS 2620, 2720
(3) Four courses chosen from PHYS 2660 and/or 3000-level physics courses

A default schedule is shown on page 16.

The classification of the courses into prerequisites and requirements, and into components, reflects the order in which classes are taken. Physics courses are more sequential than courses in some other majors. Each course descriptions in SIS may list other courses that are expected to be taken earlier (pre-requisites), or concurrently (co-requisites).

Students can substitute APMA 2120 (Multivariable Calculus) for MATH 2310 (Calculus III), APMA 2130 (Applied Differential Equations) for MATH 3250 (Ordinary Differential Equations), PHYS1425 (Introductory Physics 1 for Engineers) for PHYS 1420 (Introductory Physics 1), and PHYS 2415 (Introductory Physics 2 for Engineers) for PHYS 2410 (Introductory Physics 2). Electrical and Computer Engineering Students can substitute PHYS 2415 and PHYS 2419 with ECE 3209 (Electromagnetic Fields).

For students electing the BA program, the courses, PHYS 3110 (Widely Applied Physics), 3120 (Applied Physics: Energy), 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. PHYS 3140 (Intermediate Lab) and PHYS 2660 (Fundamentals of Scientific Computing) 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.

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. Required courses are the ones listed as component (2) and (3) above, and their substitutes. The Schools impose other requirements for graduation; e.g. students in the College of Arts and Sciences need to earn a certain number of credits, and, if not Echols scholars, have to fulfill General Education requirements.

3000-level courses that are chosen most often as electives and that are offered regularly:

PHYS 3040	Physics of the Human Body	[3]
PHYS 3110	Widely Applied Physics	[3]
PHYS 3120	Applied Physics: Energy	[3]
PHYS 3140	Intermediate Lab	[4]
PHYS 3150	Electronics	[3]

[1] MATH 2310 is the last of a course sequence that includes MATH 1310 and MATH 1320

PHYS 3170	Advanced Lab A	[3]
PHYS 3180	Advanced Lab B	[3]
PHYS 3250	Applied Nuclear Physics	[3]
PHYS 3620	Introduction to Condensed Matter Physics	[3]
PHYS 3995	Research	[3]

Classes that are admissible, but directed towards the BS majors, include:

PHYS 3210	Classical 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]

See the appendix (page 23) for a more complete list of electives.

REQUIREMENTS: BACHELOR OF ARTS (BA) IN PHYSICS (CLASS OF 2024 AND EARLIER)

The basic BA is designed for students interested in physics and planning to enter professional schools in business, law, and medicine, and for liberal arts students desiring a strong physics background, but with career objectives in other areas.

The following requirements are for students who took their introductory physics courses 2020/21 or earlier. There are two options leading to the BA in physics, each having three components:

<u>Option I</u>

(1) Prerequisites – MATH 1320 and PHYS 1710, 1720.
(2) MATH 2310, 3250 and PHYS 2620, 2630, 2640.
(3) Three courses chosen from PHYS 2660 and/or 3000-level physics courses.

<u>Option II</u>

(1) Prerequisites – MATH 1320
(2) MATH 2310, 3250 and PHYS 1425, 1429, 2415, 2419, 2620
(3) Four courses chosen from PHYS 2660 and/or 3000-level physics courses

Option II is designed to be appropriate for engineering students desiring an additional major in physics.

The classification of the courses into prerequisites and requirements, and into components, reflects the order in which classes are taken. Physics courses are more sequential than courses in some other majors. Course descriptions in SIS, or at the department webpage, may list other courses that are expected to be taken earlier (pre-requisites), or concurrently (co-requisites).

Students can substitute APMA 1110 (Single Variable Calculus II) for MATH 1320 (Calculus II), APMA 2120 (Multivariable Calculus) for MATH 2310 (Calculus III), and APMA 2130 (Applied Differential Equations) for MATH 3250 (Ordinary Differential Equations). Electrical and Computer Engineering Students can substitute PHYS 2415 and PHYS 2419 with ECE 3209 (Electromagnetic Fields).

For students electing a BA program, the courses, PHYS 3110 (Widely Applied Physics), 3120 (Applied Physics: Energy), 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. PHYS 2660 Fundamentals of Scientific Computing is a good choice for completing this component. Students completing the BA program have an outstanding record of success in admission to medical, law, business, and education schools.

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. Required courses are the ones listed as component (2) and (3) above, and their substitutes. The Schools impose other requirements for graduation; e.g. students in the College of Arts and Sciences need to earn a certain number of credits, and, if not Echols scholars, have to fulfill General Education requirements.

REQUIREMENTS: BACHELOR OF SCIENCE (BS) IN PHYSICS

The BS provides a strong preparation for graduate study in Physics and Physics-related areas, and for scientific and technical jobs.

The following requirements are for students who took their introductory physics courses 2021/22 or later. There are three groups of courses that are needed for the B.S. degree:

(1) Prerequisites – MATH 2310[2] and PHYS 1420, 1429, 2410, 2419
(2) MATH 3250 and PHYS 2620, 2660, 2720
(3) MATH 4220, and PHYS 3140, 3170 or 3180, 3210, 3310, 3340[3], 3420, 3430[4], 3650, 3660, 3995 and one 3000-5000 level Physics elective.

Default schedules are shown on pages 17, 18 and 19.

Students can substitute APMA 2120 (Multivariable Calculus) for MATH 2310 (Calculus III), APMA 2130 (Applied Differential Equations) for MATH 3250 (Ordinary Differential Equations), APMA 3140 (Applied Partial Differential Equations) for MATH 4220 (Partial Differential Equations), PHYS1425 (Introductory Physics 1 for Engineers) for PHYS 1420 (Introductory Physics 1), and PHYS 2415 (Introductory Physics 2 for Engineers) for PHYS 2410 (Introductory Physics 2).

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, and both of PHYS 3170 Advanced Laboratory 1, and PHYS 3180 Advanced Laboratory 2).

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. Required courses are the ones listed as components (2) and (3) above, and their substitutes. The School imposes other requirements for graduation; e.g. students in the College of Arts and Sciences need to earn a certain number of credits, and, if not Echols scholars, have to fulfill General Education requirements.

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 BS requirements with final grade point averages exceeding 3.4, 3.6, or 3.8, are given departmental recommendation to receive their degrees with distinction, high distinction, or highest distinction, respectively.

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[2] MATH2310 is the last of a course sequence that includes MATH1310 and MATH1320

[3] Students who are taking upper level math courses should consult with their physics advisor if those courses obviate the need for PHYS 3340 (Mathematics for Physics). If so, the advisor can waive this requirement.

[4] Your advisor may allow substituting PHYS 3430 (Electricity and Magnetism II) with PHYS 5310 (Optics), in which case PHYS 5310 would not double-count as an elective. Students that plan to continue in graduate school in physics should take PHYS 3430.

REQUIREMENTS: BACHELOR OF SCIENCE (BS) IN PHYSICS (CLASS OF 2024 AND EARLIER)

The BS provides a strong preparation for graduate study in Physics and Physics-related areas, and for scientific and technical jobs.

The following requirements are for students who took their introductory physics courses 2020/21 or earlier. There are two options leading to the BS in physics, each having three components:

Option I

(1) Prerequisites – MATH 1320 and PHYS 1710, 1720.
(2) Prerequisites – MATH 2310, 3250 and PHYS 2620, 2630, 2640.
(3) MATH 4210[5], 4220, and PHYS 2660, 3170 or 3180, 3210, 3310, 3420, 3430[6], 3650, 3660, 3995 and two 3000-5000 level Physics electives

Option I is the recommended course sequence for BS students. The default schedule is shown on page 21.

Option II

(1) Prerequisites – MATH 1320
(2) Prerequisites – MATH 2310, 3250 and PHYS 1425, 1429, 2415, 2419, 2620
(3) MATH 4210[5], 4220, and PHYS 2660, 3170 or 3180, 3210, 3310, 3420, 3430[6], 3650, 3660, 3995 and two 3000-5000 level Physics electives

Option II is often taken by students who plan (at least, initially) for a different major.

Students can substitute APMA 1110 (Applied Calculus II) for MATH 1320 (Calculus II), APMA 2120 (Multivariable Calculus) for MATH 2310 (Calculus III), APMA 2130 (Applied Differential Equations) for MATH 3250 (Ordinary Differential Equations), and APMA 3140 (Applied Partial Differential Equations) for MATH 4220.

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 Advanced Laboratory I, and PHYS 3180 Advanced 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. Required courses are the ones listed as component (3) above, and their substitutes. The School imposes other requirements for graduation; e.g. students in the College of Arts and Sciences need to earn a certain number of credits, and, if not Echols scholars, have to fulfill General Education requirements.

[5] Students who are taking upper level math courses should consult with their physics advisor if those courses obviate the need for MATH 4210 (Mathematics for Physics). If so, the advisor can waive this requirement. Note that as of Spring 2022, MATH 4210 will be replaced by PHYS 3340.

[6] Your advisor may allow substituting PHYS 3430 (Electricity and Magnetism II) with PHYS 5310 (Optics), in which case PHYS 5310 would not double-count as an elective. Students that plan to continue in graduate school in physics should take PHYS 3430.

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 BS requirements with final grade point averages exceeding 3.4, 3.6, or 3.8, are given departmental recommendation to receive their degrees with distinction, high distinction, or highest distinction, respectively.

REQUIREMENTS: BACHELOR OF SCIENCE 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 or related fields. Students in this major have advisors both from Astronomy and Physics.

The following requirements are for students who took their introductory physics courses 2021/22 or later. Students take MATH 1310, 1320, 2310, 3250, 4220; PHYS 1420, 1429, 2410, 2419, 2620, 2660, 2720, 3210, 3310, 3340, 3420, 3430, 3650; ASTR 2110, 2120, 3130, 4998 (Senior Thesis), and six additional credits of 3000-5000 level astronomy courses. The default sequence is shown on page 20.

Students can substitute PHYS1425 (Introductory Physics 1 for Engineers) for PHYS 1420 (Introductory Physics 1), and PHYS 2415 (Introductory Physics 2 for Engineers) for PHYS 2410 (Introductory Physics 2). The School imposes other requirements for graduation; e.g. students in the College of Arts and Sciences need to earn a certain number of credits, and, if not Echols scholars, have to fulfill General Education requirements.

Distinguished Astronomy-Physics Major Program - Students must maintain a GPA of 3.400 or better. For the Distinguished Major, students must meet the requirements of the Astronomy-Physics major described above and must also take PHYS 3660 (Quantum Phys. II) and a two-semester Senior Thesis (ASTR 4998). The six credits of elective astronomy courses must consist of ASTR 4810 and one additional 4000 - 5000-level astronomy lecture course. This program leads to the award of degrees with Distinction, High Distinction, or Highest Distinction.

REQUIREMENTS: BACHELOR OF SCIENCE IN ASTRONOMY/PHYSICS (CLASS OF 2024 AND EARLIER)

This is an interdepartmental major administered jointly with the Astronomy Department. The major prepares a student for graduate study in either Astronomy or Physics. Students in this major have advisors both from Astronomy and Physics.

The following requirements are for students who took their introductory physics courses 2020/21 or earlier. Required courses are MATH 1320, 2310, 3250, 4210, 4220; PHYS 1710, 1720, 2620, 2630, 2640, 2660, 3210, 3310, 3420, 3430, 3650; and ASTR 2110, 2120, 3130, 4993, 4998 (Senior Thesis), and six additional credits of 3000-5000 level Astronomy courses. The default sequence is shown on page 22.

The School imposes other requirements for graduation; e.g. students in the College of Arts and Sciences need to earn a certain number of credits, and, if not Echols scholars, have to fulfill General Education requirements.

Distinguished Astronomy-Physics Major Program - Students must maintain a GPA of 3.4 or better. For the Distinguished Major, students must meet the requirements of the Astronomy-Physics major described above and must also take PHYS 3660 (Quantum Phys. II) and a two-semester Senior Thesis (ASTR 4998). The six hours of elective Astronomy courses must consist of ASTR 4810 and a 5000-level course. This program leads to the award of degrees with Distinction, High Distinction, or Highest Distinction.

REQUIREMENTS: MINOR IN PHYSICS

In addition to a major, students may choose a minor in a second subject. The Physics Minor is for students who decided for a major in something else than physics, but who are interested in taking physics courses, and want to be able to show a basic understanding of physics.

The following requirements are for students who took their introductory physics courses 2021/22 or later. There are two options leading to a Physics Minor:

Option I

Math 2310[7] (Calculus III) and PHYS 1420, 1429, 2410, 2419 (Introductory Physics I-II for Physics Majors and accompanying workshops), 2620 (Modern Physics), 2720 (Problem Solving), and one 3000-level physics course.

Option II

Math 2310[7] (Calculus III) and PHYS 2010, 2020, 2030, 2040 (the Introductory Physics Courses that satisfy pre-health requirements), 2620 (Modern Physics), 2720 (Problem solving), and one 3000-level physics course.

This option is an offer for exceptional students only. Modern Physics, and most electives, require calculus-based physics, and mathematics preparation as it is taught in MATH 2310 (Multivariable Calculus). It is strongly recommended to see a physics major advisor, or the course instructor, before taking Modern Physics.

Students can substitute APMA 2120 (Multivariable Calculus) for MATH 2310 (Calculus III), PHYS1425 (Introductory Physics 1 for Engineers) for PHYS 1420 (Introductory Physics 1), and PHYS 2415 (Introductory Physics 2 for Engineers) for PHYS 2410 (Introductory Physics 2).

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

The college does not allow for double counting of courses between minor and major(s) for college students. A physics advisor can grant exceptions to this if the course which is to be double counted is an introductory physics course that is a required component in the major.

[7] MATH 2310 is the last of a course sequence that includes MATH 1310 and MATH 1320

REQUIREMENTS: MINOR IN PHYSICS (CLASS OF 2024 AND EARLIER)

In addition to a major, students may choose a minor in a second subject. The Physics Minor is for students who decided for a major in something else than physics, but who are interested in taking physics courses, and want to be able to show a basic understanding of physics.

The following requirements are for students who took their introductory physics courses 2021/22 or later. There are three options leading to a Physics Minor:

<u>Option I</u>

PHYS 1710, 1720 (Introductory Physics I-II for Physics Majors), 2620 (Modern Physics), and two 3000-level physics courses, or one 3000-level physics course and PHYS 2630 (Elementary Lab I).

<u>Option II</u>

PHYS 1425, 1429, 2415, 2419 (the Engineering Physics Sequence), 2620 (Modern Physics), and two 3000-level physics courses.

<u>Option III</u>

PHYS 2010, 2020, 2030, 2040 (the Introductory Physics Courses that satisfy pre-health requirements), 2620 (Modern Physics), and two 3000-level physics courses. This option is an offer for exceptional students only. Modern Physics, and most electives, require calculus-based physics, and mathematics preparation as it is taught in MATH 2310 (Multivariable Calculus). It is strongly recommended to see a physics major advisor, or the course instructor, before taking Modern Physics.

The college does not allow for double counting of courses between minor and major(s) for college students. A physics advisor can grant exceptions to this if the course which is to be double counted is an introductory physics course that is a required component in the major.

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

Example Course Sequence for BA Physics

Shown is a typical schedule for a student who intends to major with a BA in physics. The course sequence shown covers only the courses that are relevant for the major. A Physics BA can easily be started in the second year.

Fall			Spring		
First Year					
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
PHYS 1930	Phys. 21st century[8]	[2]	PHYS 1420	Intro. Physics 1	[3]
PHYS 1660	Practical Computing[8]	[1]	PHYS 1420	Intro. Phys. 1 Workshop	[1]
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Second Year					
MATH 2310	Calculus III	[4]	MATH 3250	Differential Eqn.	[4]
PHYS 2410	Intro. Physics 2	[3]	PHYS 2620	Modern Physics	[4]
PHYS 2419	Intro. Phys. 2 Workshop	[1]	PHYS 2720	Problem solving	[2]
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Third Year					
PHYS 2660	Fund. Sci. Comp.	[3]	PHYS 3140	Intermediate Lab	[4]
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Fourth Year					
PHYS 3110	Widely Applied Physics	[3]	PHYS 3120	Applied Physics: Energy	[3]
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[8] This course is not required

First Example Course Sequence for BS in Physics

The standard schedule shown here assumes no AP credit or summer classes, and it is suitable for a student who does not need to prepare for the Physics GRE in fall of the fourth year. The course sequence shown covers only the courses that are relevant for the major.

Fall			Spring		
		First Year			
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
PHYS 1930	Phys. 21st century[9]	[2]	PHYS 1420	Intro. Physics 1	[3]
PHYS 1660	Practical Computing[9]	[1]	PHYS 1420	Intro. Phys. 1 Workshop	[1]
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		Second Year			
MATH 2310	Calculus III	[4]	MATH 3250	Differential Eqn.	[4]
PHYS 2410	Intro. Physics 2	[3]	PHYS 2620	Modern Physics	[4]
PHYS 2419	Intro. Phys. 2 Workshop	[1]	PHYS 2720	Problem solving	[2]
PHYS 2660	Fund. Sci. Comp.	[3]	------------		
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		Third Year			
MATH 4220	Part. Diff. Eq.	[3]	PHYS 3340	Mathematics for Physics	[3]
PHYS 3210	Class. Mech.	[3]	PHYS 3420	Electricity & Magn. I	[3]
PHYS 3310	Statistical Physics	[3]	PHYS 3140	Intermediate Lab	[4]
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		Fourth Year			
PHYS 3430	Electricity & Magn. II	[3]	PHYS 3660	Quantum Physics II	[3]
PHYS 3650	Quantum Physics I	[3]	PHYS 3180	Advanced Lab B	[3]
PHYS 3995	Research	[3]	PHYS 3xxx	Elective	[3]
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[9] This course is not required

Second Example Course Sequence for BS in Physics

Students applying to graduate school typically take the physics GRE exam in fall of the fourth year. This course sequence allows courses relevant to the exam to be taken earlier. The schedule covers only the courses that are relevant for the major.

Fall			Spring		
		First Year			
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
PHYS 1930	Phys. 21st century[10]	[2]	PHYS 1420	Intro. Physics 1	[3]
PHYS 1660	Practical Computing[10]	[1]	PHYS 1420	Intro. Phys. 1 Workshop	[1]
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		Second Year			
MATH 2310	Calculus III	[4]	MATH 3250	Differential Eqn.	[4]
PHYS 2410	Intro. Physics 2	[3]	PHYS 2620	Modern Physics	[4]
PHYS 2419	Intro. Phys. 2 Workshop	[1]	PHYS 2720	Problem solving	[2]
PHYS 2660	Fund. Sci. Comp.	[3]	PHYS 3340	Mathematics for Physics	[3]
------------			------------		
		Third Year			
MATH 4220	Part. Diff. Eq.	[3]	PHYS 3660	Quantum Physics II	[3]
PHYS 3210	Class. Mech.	[3]	PHYS 3420	Electricity & Magn. I	[3]
PHYS 3650	Quantum Physics I	[3]	PHYS 3140	Intermediate Lab	[4]
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		Fourth Year			
PHYS 3430	Electricity & Magn. II	[3]	PHYS 3180	Advanced Lab B	[3]
PHYS 3310	Statistical Physics	[3]	PHYS 3xxx	Elective	[3]
PHYS 3995	Research	[3]	------------		
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[10] This course is not required

Third Example Course Sequence for BS in Physics

This course sequence assumes AP credit (or similar) for Calculus I, Calculus II, and Introductory Physics 1. The course sequence shown covers only the courses that are relevant for the major.

Fall			**Spring**		
			First Year		
MATH 2310	Calculus III	[4]	PHYS 2419	Intro. Phys. 2 Workshop	[1]
PHYS 2410	Intro. Physics 2	[3]	MATH 3250	Differential Eqn.	[4]
PHYS 1429	Intro. Phys. 1 Workshop	[1]	PHYS 2620	Modern Physics	[4]
------------			PHYS 2720	Problem solving	[2]
------------			------------		
			Second Year		
MATH 4220	Part. Diff. Eq.	[3]	PHYS 3420	Electricity & Magn. I	[3]
PHYS 3210	Class. Mech.	[3]	PHYS 3140	Intermediate Lab	[4]
PHYS 3310	Statistical Physics	[3]	PHYS 3340	Mathematics for Physics	[3]
PHYS 2660	Fund. Sci. Comp.	[3]	------------		
------------			------------		
			Third Year		
PHYS 3430	Electricity & Magn. II	[3]	PHYS 3660	Quantum Physics II	[3]
PHYS 3650	Quantum Physics I	[3]	PHYS 3180	Advanced Lab B	[3]
PHYS 3995	Research	[3]	PHYS 3xxx	Elective	[3]
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The schedule ends after 3 years. Some students take more advanced courses in physics, and some concentrate on a second major in their fourth year. Some students graduate early.

Example Course Sequence for BS Astronomy/Physics

This schedule is for students who intend to major with a BS in Astronomy / Physics. The course sequence shown covers only the courses that are relevant for the major. Students in the Distinguished Astronomy-Physics Major Program are required to take more courses, mostly in their last year.

Fall			**Spring**		
			First Year		
MATH 1310	Calculus I	[4]	MATH 1320	Calculus II	[4]
PHYS 1660	Practical Computing[11]	[1]	PHYS 1420	Intro. Physics 1	[3]
------------			PHYS 1420	Intro. Phys. 1 Workshop	[1]
------------			ASTR 1610[11]	Intro. Astr. Research	[1]
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			Second Year		
ASTR 2110	Intro Astrophys. I	[3]	ASTR 2120	Intro Astrophys. II	[3]
MATH 2310	Calculus III	[4]	MATH 3250	Differential Eqn.	[4]
PHYS 2410	Intro. Physics 2	[3]	PHYS 2620	Modern Physics	[4]
PHYS 2419	Intro. Phys. 2 Workshop	[1]	PHYS 2720	Problem solving	[2]
PHYS 2660	Fund. Sci. Comp.	[3]	------------		
			Third Year		
MATH 4220	Part. Diff. Eq.	[3]	PHYS 3340	Mathematics for Physics	[3]
PHYS 3210	Class. Mech.	[3]	PHYS 3420	Electricity & Magn. I	[3]
PHYS 3310	Statistical Physics	[3]	ASTR 3130	Observational Lab	[3]
------------			------------		
			Fourth Year		
PHYS 3430	Electricity & Magn. II	[3]	ASTR 3/4xxx	Astronomy elective	[3]
PHYS 3650	Quantum Physics I	[3]	ASTR 4998	Thesis	[3]
ASTR 3/4xxx	Astronomy elective	[3]	------------		
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[11] This course is not required

Example Course Sequence for BS in Physics Option 1 (Class of 2024 and earlier)

The following schedule is for students who took their introductory physics courses 2020/21 or earlier.

Fall			Spring		
		First Year			
MATH 1320	Calculus II	[4]	MATH 2310	Calculus III	[4]
PHYS 1710	Intro. Physics I	[5]	PHYS 1720	Intro. Physics II	[5]
PHYS 1910	Intro. Phys. Research[12]	[1]	PHYS 2660	Fund. Scient. Comp.	[3]
------------			------------		
		Second Year			
MATH 3250	Differential Eqn.	[3]	MATH 4210	Mathematics for Physics[13]	[3]
PHYS 2620	Modern Physics	[4]	PHYS 3210	Class. Mech.	[3]
PHYS 2630	Elem. Lab. I	[3]	PHYS 2640	Elem. Lab II	[3]
------------			------------		
		Third Year			
MATH 4220	Part. Diff. Eq.	[3]	PHYS 3420	Electricity & Magn. I	[3]
PHYS 3650	Quantum Physics I	[3]	PHYS 3660	Quantum Physics II	[3]
PHYS 3170	Intermediate Lab	[3]	PHYS 3xxx	Elective	[3]
------------			------------		
		Fourth Year			
PHYS 3995	Research	[3]	PHYS 3xxx	Elective	[3]
PHYS 3430	Electricity & Magn. II	[3]	------------		
PHYS 3310	Statistical Physics	[3]	------------		
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[12] This course is not required
[13] As of Spring 2022, MATH 4210 will be replaced by PHYS 3340

Example Course Sequence for BS Astronomy/Physics (Class of 2024 and earlier)

The following schedule is for students who took their introductory physics courses 2020/21 or earlier.

Fall			Spring		
			First Year		
MATH 1320	Calculus II	[4]	MATH 2310	Calculus III	[4]
PHYS 1710	Intro. Physics I	[5]	PHYS 1720	Intro. Physics II	[5]
------------			ASTR 1610	Intro. Astr. Research[14]	[1]
------------			------------		
			Second Year		
MATH 3250	Differential Eqn.	[3]	MATH 4210	Mathematics for Physics[15]	[3]
PHYS 2620	Modern Physics	[4]	PHYS 3210	Class. Mech.	[3]
ASTR 2110	Intro. Astroph. I	[3]	ASTR 2120	Intro. Astroph. II	[3]
PHYS 2630	Elem. Lab. I	[3]	PHYS 2640	Elem. Lab II	[3]
------------			------------		
			Third Year		
MATH 4220	Part. Diff. Eq.	[3]	PHYS 3420	Electricity & Magn. I	[3]
PHYS 3650	Quantum Physics I	[3]	PHYS 2660	Fund. Scient. Comp.	[3]
ASTR 4993	Tutorial	[3]	ASTR 3130	Observ. Astro.	[4]
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------------			------------		
			Fourth Year		
ASTR 4810	Astrophysics	[3]	ASTR 4998	Thesis	[3]
PHYS 3430	Electricity & Magn. II	[3]	ASTR 3xxx	Astro. elective	[3]
PHYS 3310	Statistical Physics	[3]	ASTR 3xxx	Astro. elective	[3]
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[14] This course is not required

[15] As of Spring 2022, MATH 4210 will be replaced by PHYS 3340.

Physics Course Schedule

The table below lists major courses and electives that are taught regularly. As the revised major requirements come into effect, the schedule for some courses will shift. The planned offerings listed below are preliminary and subject to change; always refer to SIS for the most up-to-date course offerings. Courses listed as 'as available' may not be offered every year, depending on student demand and faculty availability.

PHYS 1420	Introductory Physics I	Spring starting 2022
PHYS 1429	Introductory Physics I Workshop	Every semester
PHYS 1660	Practical Computing for the Physical Sciences	Every semester
PHYS 1930	Physics in the 21st Century	Fall starting 2021
PHYS 2410	Introductory Physics II	Fall starting 2022
PHYS 2419	Introductory Physics II Workshop	Every semester
PHYS 2620	Modern Physics	Spring starting 2022
PHYS 2630	Elementary Laboratory I	Fall 2021
PHYS 2640	Elementary Laboratory II	Spring 2022
PHYS 2660	Fundamentals of Scientific Computing	Fall 2022
PHYS 2720	Problem Solving	Spring starting 2023
PHYS 3040	Physics of the Human Body	Spring
PHYS 3110	Widely Applied Physics	Fall
PHYS 3120	Applied Physics: Energy	Spring
PHYS 3140	Intermediate Lab	Spring starting 2023
PHYS 3150	Electronics Lab	Fall
PHYS 3170	Advanced Lab A[16]	Fall
PHYS 3180	Advanced Lab B[17]	Spring
PHYS 3210	Classical Mechanics	Spring 2022, Fall starting 2023
PHYS 3250	Applied Nuclear Physics	Spring
PHYS 3310	Statistical Physics	Fall
PHYS 3340	Mathematics for Physics[18]	Spring
PHYS 3420	Electricity and Magnetism I	Spring
PHYS 3420	Electricity and Magnetism II	Fall
PHYS 3620	Introduction to Condensed Matter Physics	Spring, as available
PHYS 3650	Quantum Physics I	Fall
PHYS 3660	Quantum Physics II	Spring
PHYS 3993	Independent Study	Every semester
PHYS 3995	Research	Every semester
PHYS 5160	Introduction to String Theory	Spring, as available
PHYS 5170	Introduction to Cosmology	Fall, as available
PHYS 5240	Introduction to General Relativity	Spring
PHYS 5250	Mathematical Methods of Physics I	Fall, as available
PHYS 5310	Optics	Fall, as available
PHYS 5320	Fundamentals of Photonics	Spring, as available
PHYS 5620	Introduction to Solid State Physics	Fall, as available
PHYS 5630	Computational Physics I	Fall
PHYS 5640	Computational Physics II	Spring
PHYS 5720	Introduction to Nuclear and Particle Physics	Fall, as available
PHYS 5880	Introduction to Quantum Computing	Fall, as available

[16] Equivalent to PHYS 3170 Intermediate Lab 1
[17] Equivalent to PHYS 3180 Intermediate Lab 2
[18] Replaces MATH 4210, starting in Spring 2022