PHYSICS MAJOR, B.S.

Everything around you is influenced or governed by physics. Physics seeks to understand the fundamental workings of the universe, from the smallest particles like neutrinos to the vast structure of the cosmos. It unveils the underlying principles governing the world around us and serves as the cornerstone of all natural sciences, including chemistry, biology, oceanography, and geography.

The Department of Physics and Astronomy offers a range of degree tracks tailored to various interests and career paths:

- B.A. Tracks
  - Physics
  - Astronomy
  - Computational Physics
  - Energy
  - Engineering Physics
  - Medical and Biological Physics
  - Quantitative Finance
- B.S. Tracks
  - Physics
  - Astrophysics

These tracks align with diverse employment opportunities (https://www.aps.org/careers/physicists/prospects.cfm) for physics graduates, spanning high schools, government laboratories, financial institutions, medical facilities, data science, and high-tech industries.

Upon graduation, approximately 50 percent of physics bachelors transition directly into the workforce, while others pursue advanced degrees in physics, medical physics, business, law, or computer science.

Opt for a B.A. degree if you seek to blend your passion for physics with complementary disciplines such as computer science, environmental science, biophysics, medicine, engineering, or finance.

Consider a B.S. degree if you intend to pursue graduate study in physics, astronomy, or a related field, or a career practicing physics.

Student Learning Outcomes

Upon completion of the physics program, students should be able to:

- Demonstrate knowledge of major concepts, theoretical reasoning, and empirical findings in physics and/or astronomy — Knowledge Base in Physics
- Use physics and mathematics knowledge to solve problems — Critical Thinking and Problem Solving
- Effectively conduct research under faculty guidance — Research and the Advancement of Physics and Astronomy
- Gain entry to top graduate programs, employment as physicists in industry, teaching positions in high school physics and astronomy, or leverage their skills in other rewarding careers — Preparation for Future Career

Requirements

In addition to the program requirements, students must

- earn a minimum final cumulative GPA of 2.000
- complete a minimum of 45 academic credit hours earned from UNC–Chapel Hill courses
- take at least half of their major core requirements (courses and credit hours) at UNC–Chapel Hill
- earn a minimum cumulative GPA of 2.000 in the major core requirements. Some programs may require higher standards for major or specific courses.

For more information, please consult the degree requirements section of the catalog (https://catalog.unc.edu/undergraduate/degree-requirements/).

Physics Major, B.S.–Standard Option

Code	Title	Hours
Core Requirements		
PHYS 281L	Experimental Techniques in Physics	3
PHYS 331	Numerical Techniques for the Sciences I	4
PHYS 332	Numerical Techniques for the Sciences II [1]	4
PHYS 401	Mechanics I [2]	3
PHYS 311	Electromagnetism I [1]	3
PHYS 412	Electromagnetism II [2]	3
PHYS 421	Introduction to Quantum Mechanics [2]	3
PHYS 451	Electronics I [1]	4
PHYS 521	Applications of Quantum Mechanics [1]	3
PHYS 441	Thermal Physics [1]	3
PHYS 481L	Advanced Laboratory I [2]	2
PHYS 395	Research with Faculty Mentor II	3
or PHYS 692H	Senior Honor Thesis Research II	
Six additional credit hours chosen from:		6
ASTR 202	Introduction to Astrophysics	
ASTR (numbered above 300)		
PHYS (numbered above 300 except PHYS 395)		
MATH 528	Mathematical Methods for the Physical Sciences I	
MATH 529	Mathematical Methods for the Physical Sciences II	
PHYS 231	Physical Computing [2, H]	
Additional Requirements		
PHYS 118	Introductory Calculus-based Mechanics and Relativity [H, F]	4
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta [H, F]	4
MATH 231	Calculus of Functions of One Variable I [H, F]	4
MATH 232	Calculus of Functions of One Variable II [H, F]	4
MATH 233	Calculus of Functions of Several Variables [H, F]	4
MATH 383	First Course in Differential Equations [H]	3
CHEM 101 & 101L	General Descriptive Chemistry I and Quantitative Chemistry Laboratory I (CHEM 102/CHEM 102L are recommended but not required) [H, F]	4

Remaining General Education requirements and enough free electives to accumulate 120 academic hours	49
Total Hours	**120**

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

[1] Fall course.
[2] Spring course.

Astronomy (ASTR) and Physics (PHYS) course descriptions (https://catalog.unc.edu/undergraduate/departments/physics-astronomy/#coursestext).

Physics Major, B.S.–Astrophysics Option

Code	Title	Hours
Core Requirements		
PHYS 281L	Experimental Techniques in Physics	3
PHYS 331	Numerical Techniques for the Sciences I	4
PHYS 332	Numerical Techniques for the Sciences II [1]	4
PHYS 401	Mechanics I [2]	3
PHYS 311	Electromagnetism I [1]	3
PHYS 412	Electromagnetism II [2]	3
PHYS 421	Introduction to Quantum Mechanics [2]	3
PHYS 521	Applications of Quantum Mechanics [1]	3
PHYS 441	Thermal Physics [1]	3
ASTR 519	Observational Astronomy [1]	4
PHYS 395	Research with Faculty Mentor II	3
or PHYS 692H	Senior Honor Thesis Research II	
One additional course chosen from ASTR (numbered above 300)		3
Six or more additional credit hours chosen from:		6
ASTR (numbered above 300)		
MATH 528	Mathematical Methods for the Physical Sciences I	
MATH 529	Mathematical Methods for the Physical Sciences II	
PHYS 231	Physical Computing [2, H]	
PHYS 451	Electronics I [1]	
PHYS 632	Advanced Research Analytics	
Additional Requirements		
PHYS 118	Introductory Calculus-based Mechanics and Relativity [H, F]	4
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta [H, F]	4
ASTR 202	Introduction to Astrophysics (CHEM 101/CHEM 101L are recommended but not required) [1]	3
MATH 231	Calculus of Functions of One Variable I [H, F]	4
MATH 232	Calculus of Functions of One Variable II [H, F]	4
MATH 233	Calculus of Functions of Several Variables [H, F]	4
MATH 383	First Course in Differential Equations [H]	3
Remaining General Education requirements and enough free electives to accumulate 120 academic hours		49
Total Hours		**120**

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

[1] Fall course.
[2] Spring course.

Astronomy (ASTR) and Physics (PHYS) course descriptions (https://catalog.unc.edu/undergraduate/departments/physics-astronomy/#coursestext).

It is strongly recommended that students planning to major in physics fulfill the Foundations requirement in English composition and rhetoric by enrolling in ENGL 105I.

Most students will find it advantageous to defer some of the General Education requirements to the junior and/or senior year(s).

Sample Plan of Study

Sample plans can be used as a guide to identify the courses required to complete the major and other requirements needed for degree completion within the expected eight semesters. The actual degree plan may differ depending on the course of study selected (second major, minor, etc.). Students should meet with their academic advisor to create a degree plan that is specific and unique to their interests. The sample plans represented in this catalog are intended for first-year students entering UNC–Chapel Hill in the fall term. Some courses may not be offered every term.

Standard Option

Sample I (for students placed into MATH 231)

First Year		Hours
First-Year Foundation Courses		
IDST 101	College Thriving	1
ENGL 105 or ENGL 105I	English Composition and Rhetoric or English Composition and Rhetoric (Interdisciplinary)	3
First-Year Seminar or First-Year Launch (https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/) [F]		3
Triple-I and Data Literacy (https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/)		4
Global Language through level 3 (https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/)		varies
Hours		**11**

Fall Semester		
MATH 231	Calculus of Functions of One Variable I [H, F]	4
CHEM 101 & 101L	General Descriptive Chemistry I and Quantitative Chemistry Laboratory I [H, F]	4
Hours		**8**
Spring Semester		
PHYS 118	Introductory Calculus-based Mechanics and Relativity [H, F]	4
MATH 232	Calculus of Functions of One Variable II [H, F]	4
Hours		**8**
Sophomore Year		
Fall Semester		
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta [H, F]	4
MATH 233	Calculus of Functions of Several Variables [H, F]	4
Hours		**8**
Spring Semester		
PHYS 281L	Experimental Techniques in Physics	3
PHYS 401	Mechanics I	3
PHYS 331	Numerical Techniques for the Sciences I	4
MATH 383	First Course in Differential Equations [H]	3
Hours		**13**
Junior Year		
Fall Semester		
PHYS 311	Electromagnetism I	3
PHYS 332	Numerical Techniques for the Sciences II	4
PHYS 451	Electronics I	4
Hours		**11**
Spring Semester		
PHYS 412	Electromagnetism II	3
PHYS 421	Introduction to Quantum Mechanics	3
PHYS 395	Research with Faculty Mentor II [2]	3
Hours		**9**
Senior Year		
Fall Semester		
PHYS 441	Thermal Physics	3
PHYS 521	Applications of Quantum Mechanics	3
One elective course [1]		3
Hours		**9**
Spring Semester		
PHYS 481L	Advanced Laboratory I	2
One elective course [1]		3
Hours		**5**
Total Hours		**82**

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

1 Courses may be chosen from ASTR (numbered above 300), MATH 528, MATH 529, PHYS 231, PHYS (numbered above 300).

2 Students who complete a senior honors thesis (PHYS 691H and PHYS 692H) may use PHYS 692H to fulfill the PHYS 395 requirement in the major.

Sample II (for students placed into MATH 232)

First Year		**Hours**
First-Year Foundation Courses		
IDST 101	College Thriving	1
ENGL 105 or ENGL 105I	English Composition and Rhetoric or English Composition and Rhetoric (Interdisciplinary)	3
First-Year Seminar or First-Year Launch (https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/) [F]		3
Triple-I and Data Literacy (https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/)		4
Global Language through level 3 (https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/)		varies
Hours		**11**
Fall Semester		
PHYS 118	Introductory Calculus-based Mechanics and Relativity [H, F]	4
MATH 232	Calculus of Functions of One Variable II [H, F]	4
Hours		**8**
Spring Semester		
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta [H, F]	4
MATH 233	Calculus of Functions of Several Variables [H, F]	4
CHEM 101 & 101L	General Descriptive Chemistry I and Quantitative Chemistry Laboratory I [H, F]	4
Hours		**12**
Sophomore Year		
Fall Semester		
PHYS 281L	Experimental Techniques in Physics	3
MATH 383	First Course in Differential Equations [H]	3
PHYS 331	Numerical Techniques for the Sciences I	4
Hours		**10**
Spring Semester		
PHYS 401	Mechanics I	3
One elective course [1]		3
Hours		**6**
Junior Year		
Fall Semester		
PHYS 311	Electromagnetism I	3
PHYS 332	Numerical Techniques for the Sciences II	4

PHYS 451	Electronics I	4
Hours		**11**
Spring Semester		
PHYS 412	Electromagnetism II	3
PHYS 421	Introduction to Quantum Mechanics	3
PHYS 395	Research with Faculty Mentor II [2]	3
Hours		**9**
Senior Year		
Fall Semester		
PHYS 441	Thermal Physics	3
PHYS 521	Applications of Quantum Mechanics	3
Hours		**6**
Spring Semester		
PHYS 481L	Advanced Laboratory I	2
One elective course [1]		3
Hours		**5**
Total Hours		**78**

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

1 Courses may be chosen from ASTR (numbered above 300), MATH 528, MATH 529, PHYS 231, PHYS (numbered above 300).

2 Students who complete a senior honors thesis (PHYS 691H and PHYS 692H) may use PHYS 692H to fulfill the PHYS 395 requirement in the major.

Astrophysics Option

Sample I (for students placed into MATH 231)

First Year		**Hours**
First-Year Foundation Courses		
IDST 101	College Thriving	1
ENGL 105 or ENGL 105I	English Composition and Rhetoric or English Composition and Rhetoric (Interdisciplinary)	3
First-Year Seminar or First-Year Launch (https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/) [F]		3
Triple-I and Data Literacy (https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/)		4
Global Language through level 3 (https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/)		varies
Hours		**11**
Fall Semester		
MATH 231	Calculus of Functions of One Variable I [H, F]	4
Hours		**4**
Spring Semester		
PHYS 118	Introductory Calculus-based Mechanics and Relativity [H, F]	4
MATH 232	Calculus of Functions of One Variable II [H, F]	4
Hours		**8**
Sophomore Year		
Fall Semester		
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta [H, F]	4
MATH 233	Calculus of Functions of Several Variables [H, F]	4
ASTR 202	Introduction to Astrophysics	3
Hours		**11**
Spring Semester		
PHYS 281L	Experimental Techniques in Physics	3
PHYS 331	Numerical Techniques for the Sciences I	4
PHYS 401	Mechanics I	3
MATH 383	First Course in Differential Equations [H]	3
Hours		**13**
Junior Year		
Fall Semester		
PHYS 311	Electromagnetism I	3
PHYS 332	Numerical Techniques for the Sciences II	4
ASTR 519	Observational Astronomy	4
Hours		**11**
Spring Semester		
PHYS 412	Electromagnetism II	3
PHYS 421	Introduction to Quantum Mechanics	3
One additional course chosen from ASTR (numbered above 300)		3
PHYS 395	Research with Faculty Mentor II [2]	3
Hours		**12**
Senior Year		
Fall Semester		
PHYS 441	Thermal Physics	3
PHYS 521	Applications of Quantum Mechanics	3
One elective course [1]		3
Hours		**9**
Spring Semester		
One elective course [1]		3
Hours		**3**
Total Hours		**82**

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

1 Course may be chosen from ASTR (numbered above 300), MATH 528, MATH 529, PHYS 231, PHYS 451, PHYS 632.

[2] Students who complete a senior honors thesis (PHYS 691H and PHYS 692H) may use PHYS 692H to fulfill the PHYS 395 requirement in the major.

Sample II (for students placed into MATH 232)

First Year		Hours
First-Year Foundation Courses		
IDST 101	College Thriving	1
ENGL 105 or ENGL 105I	English Composition and Rhetoric or English Composition and Rhetoric (Interdisciplinary)	3
First-Year Seminar or First-Year Launch (https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/) [F]		3
Triple-I and Data Literacy (https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/)		4
Global Language through level 3 (https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/)		varies
Hours		**11**
Fall Semester		
PHYS 118	Introductory Calculus-based Mechanics and Relativity [H, F]	4
MATH 232	Calculus of Functions of One Variable II [H, F]	4
Hours		**8**
Spring Semester		
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta [H, F]	4
MATH 233	Calculus of Functions of Several Variables [H, F]	4
Hours		**8**
Sophomore Year		
Fall Semester		
PHYS 281L	Experimental Techniques in Physics	3
MATH 383	First Course in Differential Equations [H]	3
ASTR 202	Introduction to Astrophysics	3
Hours		**9**
Spring Semester		
PHYS 401	Mechanics I	3
PHYS 331	Numerical Techniques for the Sciences I	4
One additional course chosen from ASTR (numbered above 300)		3
Hours		**10**
Junior Year		
Fall Semester		
PHYS 311	Electromagnetism I	3
PHYS 332	Numerical Techniques for the Sciences II	4
ASTR 519	Observational Astronomy	4
Hours		**11**
Spring Semester		
PHYS 412	Electromagnetism II	3
PHYS 421	Introduction to Quantum Mechanics	3
PHYS 395	Research with Faculty Mentor II [2]	3
One elective course [1]		3
Hours		**12**
Senior Year		
Fall Semester		
PHYS 441	Thermal Physics	3
PHYS 521	Applications of Quantum Mechanics	3
Hours		**6**
Spring Semester		
One elective course [1]		3
Hours		**3**
Total Hours		**78**

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

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[1] Course may be chosen from ASTR (numbered above 300), MATH 528, MATH 529, PHYS 231,PHYS 451, PHYS 632.

[2] Students who complete a senior honors thesis (PHYS 691H and PHYS 692H) may use PHYS 692H to fulfill the PHYS 395 requirement in the major.

Special Opportunities in Physics and Astronomy

Honors in Physics and Astronomy

The honors program offers exceptionally well-qualified students an opportunity to perform original research with a faculty member and graduate with honors or highest honors. It requires an overall grade point average of at least 3.3 and a grade point average of at least 3.4 for physics courses at the end of the junior year.

Students who wish to enter the honors program should consult with the departmental coordinator (http://physics.unc.edu/undergraduate-program/undergraduate-research/) for the program no later than the preregistration period in the spring semester of their junior year.

Undergraduate Research

More than half of our B.A. majors, alongside all B.S. majors, engage in at least one semester of research under the guidance of a faculty member. Many students find the experience so rewarding that they choose to continue for several semesters. PHYS 395 Research with Faculty Mentor II is a required course for all of our B.S. majors. In addition to PHYS 395, students have the option to enroll in PHYS 295 Research with Faculty Mentor I as many times as desired. These courses provide students with the opportunity to participate in cutting-edge research and acquire hands-on experience with various experimental tools and techniques, which can significantly enhance their resumes. Students may also earn course credit while pursuing internship opportunities in a physics-related industry by enrolling in PHYS 293. An approved learning contract is required prior to registering for PHYS 295, PHYS 395, and PHYS 293. Learning contracts and registration must be completed within the first week of classes.

Departmental Involvement

Within our department, two student-led organizations have their dedicated physical spaces. Both of these student organizations organize events throughout the year aimed at fostering social interaction within our student body, as well as facilitating connections between students and faculty.

The Society of Physics Students (https://uncsps.com/) is open to anyone interested in physics and is meant to build connections between undergraduates, graduate students, faculty, and alumni. Each year the society invites visitors to give talks and sponsors a number of events for students.

The Visibility in Physics (https://physics.unc.edu/undergraduate/student-organizations/visibility-in-physics/) is a student organization that aims to provide resources, advice, and a welcoming and encouraging social atmosphere for underrepresented minorities and allies in the field of physics.

Department Awards

The Physics and Astronomy department grants two annual awards to acknowledge academic excellence: the Shearin Award, for the most outstanding senior, and the Johnson Award, for the most outstanding junior. In addition, the Robert Sheldon Award for Undergraduate Research is presented to the student who demonstrates the most remarkable research accomplishments in the major.

Department Advising Program

Within the Physics and Astronomy Department, all majors, alongside their primary academic advisor from the Academic Advising Program (https://advising.unc.edu/), are assigned a department advisor. A list of department advisors can be found on the Physics Department Undergraduate webpage (https://physics.unc.edu/undergrad/).

These advisors, who are faculty members of the Physics and Astronomy Department, provide guidance to students on physics course planning, facilitate undergraduate research opportunities, offer support through the honors program, assist with internships, explore career prospects, and provide guidance with graduate school and fellowship applications.

All physics majors are required to meet with their department advisor by appointment prior to registering for any semester beyond the fourth term in residence. Further information may be obtained from the department's website under the Undergraduate Program (http://physics.unc.edu/undergraduate-program/).

If you are interested in physics or astronomy and you are considering majoring in this field, you should contact one of our department advisors.

Department Programs

Majors

- Physics Major, B.A (https://catalog.unc.edu/undergraduate/programs-study/physics-major-ba/).
  - Physics
  - Astronomy
  - Computational Physics
  - Energy
  - Engineering Physics
  - Medical and Biological Physics
  - Quantitative Finance
- Physics Major, B.S. (p. 1)
  - Physics
  - Astrophysics

Minors

- Astronomy Minor (https://catalog.unc.edu/undergraduate/programs-study/astronomy-minor/)
- Physics Minor (https://catalog.unc.edu/undergraduate/programs-study/physics-minor/)

Graduate Programs

- M.S. in Physics (https://catalog.unc.edu/graduate/schools-departments/physics-astronomy/)
- Ph.D. in Physics (https://catalog.unc.edu/graduate/schools-departments/physics-astronomy/)

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