

BACHELOR OF SCIENCE (BS) DEGREE WITH A MAJOR IN PHYSICS AND A MAJOR CONCENTRATION IN COMPUTATIONAL PHYSICS

Program Learning Outcomes for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics

Upon completing the BS degree with a major in Physics, students will be able to:

1. Demonstrate an understanding of fundamental concepts in Mechanics.
2. Demonstrate an understanding of fundamental concepts in Electromagnetism.
3. Demonstrate an understanding of fundamental concepts in Quantum Mechanics.

Additionally, upon completing the BS degree with a major in Physics and a major concentration in Computational Physics, students will be able to:

1. Be knowledgeable of the use of numerical analysis to apply the laws of physics to real-world problems.
2. Demonstrate proficiency in research techniques and methodology under guidance of a faculty member.
3. Communicate scientific results both in writing and oral presentations.

Requirements for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics

For general university requirements, see [Graduation Requirements \(https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/\)](https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/). Students pursuing the BS degree with a major in Physics and a major concentration in Computational Physics must complete:

- A minimum of 72 credit hours to satisfy major requirements.
- A minimum of 120 credit hours to satisfy degree requirements.
- A minimum of 38 credit hours taken at the 300-level or above.
- Core courses common to all major concentrations.
- The requirements for the major concentration in Computational Physics. When students **declare the major** (<https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/#text>) in Physics, students must additionally identify and declare one of four major concentrations, either in:
 - [Applied Physics \(https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/applied-physics-bs/#requirementstext\)](https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/applied-physics-bs/#requirementstext), or

- [Biological Physics \(https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/biological-physics-bs/#requirementstext\)](https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/biological-physics-bs/#requirementstext), or
- [Computational Physics \(p. 1\)](#), or
- [General Physics \(https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/general-physics-bs/#requirementstext\)](https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/general-physics-bs/#requirementstext).

Because of the common core requirements, it is possible for students to change their major concentration at any time, even after initially declaring the major. To do so, please contact the [Office of the Registrar \(registrar@rice.edu\)](mailto:registrar@rice.edu).

Students may obtain credit for some courses by advanced placement, and the department's undergraduate committee can modify requirements to meet the needs of students with special backgrounds.

The courses listed below satisfy the requirements for this major. In certain instances, courses not on this official list may be substituted upon approval of the Physics and Astronomy department's undergraduate committee. (Course substitutions must be formally applied and entered into Degree Works by the major's [Official Certifier \(https://registrar.rice.edu/facstaff/degreeworks/officialcertifier/\)](https://registrar.rice.edu/facstaff/degreeworks/officialcertifier/).) Students and their academic advisors should identify and clearly document the courses to be taken.

Summary

Code	Title	Credit Hours
Total Credit Hours Required for the Major in Physics and a Major Concentration in Computational Physics		72
Total Credit Hours Required for the BS Degree with a Major in Physics and Major Concentration in Computational Physics		120

Degree Requirements

Code	Title	Credit Hours
Core Requirements		
MATH 101 or MATH 105	SINGLE VARIABLE CALCULUS I ¹ AP/OTH CREDIT IN CALCULUS I	3
MATH 102 or MATH 106	SINGLE VARIABLE CALCULUS II ¹ AP/OTH CREDIT IN CALCULUS II	3
MATH 211 or MATH 220 or MATH 221	ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA HONORS ORDINARY DIFFERENTIAL EQUATIONS HONORS CALCULUS III	3
MATH 212 or MATH 222 or MATH 232	MULTIVARIABLE CALCULUS HONORS CALCULUS IV HONORS MULTIVARIABLE CALCULUS	3
<i>Select 1 from the following:</i> ²		4
PHYS 101 & PHYS 103	MECHANICS (WITH LAB) and MECHANICS DISCUSSION	
PHYS 111	HONORS MECHANICS (WITH LAB)	
<i>Select 1 from the following:</i> ³		4
PHYS 102 & PHYS 104	ELECTRICITY & MAGNETISM (WITH LAB) and ELECTRICITY AND MAGNETISM DISCUSSION	

PHYS 112	HONORS ELECTRICITY & MAGNETISM (WITH LAB)	
PHYS 201	WAVES, LIGHT, AND HEAT	3
PHYS 202	MODERN PHYSICS	3
PHYS 231	ELEMENTARY PHYSICS LAB	1
PHYS 301	INTERMEDIATE MECHANICS	4
PHYS 311	INTRODUCTION TO QUANTUM PHYSICS I	3
PHYS 491 & PHYS 493	UNDERGRADUATE RESEARCH and UNDERGRADUATE RESEARCH SEMINAR ⁴	3
PHYS 492 & PHYS 494	UNDERGRADUATE RESEARCH and UNDERGRADUATE RESEARCH SEMINAR ⁵	3

Code	Title	Credit Hours
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Major Concentration in Computational Physics ⁶

PHYS 302	INTERMEDIATE ELECTRODYNAMICS	4
PHYS 312	INTRODUCTION TO QUANTUM PHYSICS II	3
or PHYS 425	STATISTICAL & THERMAL PHYSICS	
PHYS 416	COMPUTATIONAL PHYSICS	3
CMOR 220	INTRODUCTION TO ENGINEERING COMPUTATION	3
CMOR 303	MATRIX ANALYSIS FOR DATA SCIENCE	3
or CMOR 302	MATRIX ANALYSIS	
or MATH 354	HONORS LINEAR ALGEBRA	
or MATH 355	LINEAR ALGEBRA	
CMOR 304	DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING	3
or MATH 381	INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS	
CMOR 422	NUMERICAL ANALYSIS	3
COMP 140	COMPUTATIONAL THINKING	4
<i>Select 2 courses from the following:</i>		6
CMOR 420	COMPUTATIONAL SCIENCE	
CMOR 421	HIGH PERFORMANCE COMPUTING	
CMOR 423	NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS	
CMOR 435 / MATH 435	DYNAMICAL SYSTEMS	
MECH 454	COMPUTATIONAL FLUID MECHANICS	
PHYS 449	PROJECTS IN DATA-ENABLED PHYSICS THROUGH DATA SCIENCE AND MACHINE LEARNING	
PHYS 580	INTRODUCTION TO PLASMA PHYSICS	

Total Credit Hours Required for the Major in Physics and a Major Concentration in Computational Physics **72**

Additional Credit Hours to Complete Degree Requirements ^{*} 17

[University Graduation Requirements \(https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/\)](https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/) ^{*} 31

Total Credit Hours **120**

Footnotes and Additional Information

^{*} **Note:** [University Graduation Requirements](#) include 31 credit hours, comprised of Distribution Requirements (Groups I, II, and III), FWIS, and LPAP coursework. In some instances, courses satisfying FWIS or distribution requirements may additionally meet other requirements, such as the Analyzing Diversity (AD) requirement, or some of the student's declared major, minor, or certificate requirements. [Additional Credit Hours to Complete Degree Requirements](#) include general electives, coursework completed as upper-level, residency (hours taken at Rice), and/or any other additional academic program requirements.

¹ Students without credit for basic calculus (e.g. MATH 101/MATH 105 and/or MATH 102/MATH 106) must either enroll in the relevant course(s) or substitute more advanced MATH or CMOR coursework, with prior approval by the Physics and Astronomy department's Undergraduate Program Committee, to earn the required credit.

² The Physics department has determined that credit awarded for PHYS 141 *CONCEPTS IN PHYSICS I* is not eligible for meeting the requirements of the Physics major.

³ The Physics department has determined that credit awarded for PHYS 142 *CONCEPTS IN PHYSICS II* is not eligible for meeting the requirements of the Physics major.

⁴ PHYS 491 and PHYS 493 must be taken concurrently.

⁵ PHYS 492 and PHYS 494 must be taken concurrently.

⁶ Because of common core requirements, it is possible to change major concentrations even after declaring the major. See the Undergraduate tab of the Physics and Astronomy department listing for the requirements for each major concentration for the BS degree in Physics.

Policies for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics**Program Restrictions and Exclusions**

Students pursuing the BS Degree with a Major in Physics and a Major Concentration in Computational Physics should be aware of the following program restrictions:

- As noted in [Majors, Minors, and Certificates \(https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/\)](https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/) under *Declaring Majors, Minors and Certificates*, students may not obtain both a BA and a BS in the same major. Students pursuing the BS Degree with a Major in Physics and a Major Concentration in Computational Physics may not additionally pursue the BA Degree with a Major in Physics.
- Students pursuing the major in Physics may pursue only one major concentration within the major.
- As noted in [Majors, Minors, and Certificates \(https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/\)](https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/), students may not major and minor in the same subject.

Transfer Credit

For Rice University's policy regarding transfer credit, see [Transfer Credit \(https://ga.rice.edu/undergraduate-students/academic-policies-procedures/transfer-credit/\)](https://ga.rice.edu/undergraduate-students/academic-policies-procedures/transfer-credit/). Some departments and programs have additional restrictions on transfer credit. Requests for transfer credit must be approved for Rice equivalency by the designated transfer credit advisor for the appropriate academic department offering the Rice

equivalent course (corresponding to the subject code of the course content). The Office of Academic Advising maintains the university's official list of [transfer credit advisors](https://oaa.rice.edu/advising-network/transfer-credit-advisors/) (<https://oaa.rice.edu/advising-network/transfer-credit-advisors/>) on their website: <https://oaa.rice.edu>. Students are encouraged to meet with the applicable transfer credit advisor as well as their academic program director when considering transfer credit possibilities.

Additional Information

For additional information, please see the Physics and Astronomy website: <https://physics.rice.edu/>.

Opportunities for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics

Academic Honors

The university recognizes academic excellence achieved over an undergraduate's academic history at Rice. For information on university honors, please see [Latin Honors](https://ga.rice.edu/undergraduate-students/honors-distinctions/university/) (<https://ga.rice.edu/undergraduate-students/honors-distinctions/university/>) (*summa cum laude*, *magna cum laude*, and *cum laude*) and [Distinction in Research and Creative Work](https://ga.rice.edu/undergraduate-students/honors-distinctions/university/) (<https://ga.rice.edu/undergraduate-students/honors-distinctions/university/>). Some departments have department-specific Honors awards or designations.

Research in the Department of Physics and Astronomy

The Physics and Astronomy Department encourages undergraduate participation in research, both within the department and through extramural programs. For current opportunities, please click on the *Research* tab on the [department website](https://physics.rice.edu/) (<https://physics.rice.edu/>).

Additional Information

For additional information, please see the Physics and Astronomy website: <https://physics.rice.edu/>.