

Physics (PHYS)

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Department of Physics Website (<https://fulbright.uark.edu/departments/physics/>)

The Department of Physics offers two undergraduate majors, one leading to a Bachelor of Science degree in physics and a second leading to a Bachelor of Arts degree in physics.

Physicists ask questions and try to find answers to almost everything. If you have wondered about rainbows, thunderstorms, why stars shine, the colors of beetles, why curve balls curve, how the universe began, or how quarks and leptons interact – if you like to explore and figure out why things are the way they are – you might want to become a physicist.

The Bachelor of Science degree program is designed for students interested in professional employment or who want to pursue graduate work in physics or closely related fields such as astronomy, engineering, laser technology, or computational science. It offers the option of one of seven concentrations.

The Bachelor of Arts degree program provides a broad background in the physics and technology of today and tomorrow. Training in physics provides students with a unique background, the usefulness of which transcends the boundaries of the professional disciplines.

In our increasingly technological society, scientific literacy is ever more important for the successful employee. Physics, the most fundamental science, gives students the fascination of studying the deepest principles of the universe while preparing them for a wide range of practical employment.

For information on advanced degrees in physics, see the Graduate School Catalog (<http://catalog.uark.edu/graduatecatalog/programsofstudy/physicsphys/>).

Requirement for B.S. Degree with a Major in Physics

University and College Requirements for a Bachelor of Science in Physics:

In addition to the Fulbright College of Arts and Sciences Graduation Requirements (see under Degree Completion Program Policy), the following course requirements must be met. **Bolded** courses from the course list below may be applied to portions of the University/state minimum core (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/>) requirements.

University/State Minimum Core	35
Students must complete the following:	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034)	4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
PHYS 20504 University Physics III	4
PHYS 34503 Electromagnetic Theory I	3
PHYS 36103 Modern Physics	3

PHYS 40703	Introduction to Quantum Mechanics	3
PHYS 49901	Physics Senior Seminar ¹	1

Mathematics Courses:

MATH 24004	Calculus I (ACTS Equivalency = MATH 2405)	4
MATH 25004	Calculus II	4
MATH 26004	Calculus III	4
MATH 25804	Elementary Differential Equations	4
MATH 30803	Linear Algebra ²	3

Additional Science

At least 8 hours of other science chosen from: 8

CHEM 14103 University Chemistry I (ACTS Equivalency = & CHEM 14101CHEM 1414 Lecture)
and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = & CHEM 14201CHEM 1424 Lecture)
and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I

CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL & BIOL 10101 1014 Lecture)
and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)

BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL & GEOL 11101 1114 Lecture)
and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 & GEOL 11201 Lecture)
and Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

Concentration Requirements 16-24

Physics B.S. majors must complete all the requirements for one of seven available concentration areas. All concentrations consist of 16 credit hours with the exception of the Geophysics concentration, which requires 24.

University Residency Requirement Electives (See Degree Completion Program Policy) 1

General Electives 11-19

Total Hours 120

¹ Majors must propose participation in a research experience project no later than the end of their junior year of study. A written report of the results must be submitted during Senior Seminar (PHYS 49901).

² CSCE 35103, CSCE 44203, MEEG 27003, or GEOS 42203 can be substituted for MATH 30803 with the adviser's approval.

Astronomy Concentration

PHYS 35404	Optics	4
6 semester hours of ASTR courses numbered 3000 or above (ASTR 40303, ASTR 40403, ASTR 40703, ASTR 40803)		6

6 additional hours numbered 3000 and above in physics or astronomy 6

Total Hours 16

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.S. with Astronomy Concentration Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/>) in the Academic Regulations chapter for university requirements of the program as well as Fulbright College requirements.

University/state minimum core requirements may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute with general electives. Students should consult with their academic advisor.

First Year	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1) ¹	4	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)	4	
Fine Arts State Minimum Core (Satisfies General Education Outcome 3.1) ²	3	
General Electives	1	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 25004 Calculus II		4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)		4
Humanities State Minimum Core (Select a course which satisfies both General Education Outcomes 3.2 and 5.1) ³		3
General Electives		1

Year Total: 15 15

Second Year	Units	
	Fall	Spring
MATH 26004 Calculus III	4	
PHYS 20504 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations:	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 20004 Programming Foundations I		
CSCE 20104 Programming Foundations II		
BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab) or an approved four credit hours of other laboratory-based courses from these departments.		
U.S. History or Government State Minimum Core (Satisfies General Education Outcome 4.2)	3	
MATH 25804 Elementary Differential Equations		4
PHYS 36103 Modern Physics		3
Select one of the following four-hour lecture/lab combinations		4
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 20004 Programming Foundations I		
CSCE 20104 Programming Foundations II		

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)
 GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)
 GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)
 or an approved four credit hours of other laboratory-based courses from these departments.

Social Sciences State Minimum Core (Select a course which satisfies both General Education Outcomes 3.3 and 4.1) ⁴		3
General Electives		1
Year Total:	15	15

Third Year	Units	
	Fall	Spring
MATH 30803 Linear Algebra	3	
PHYS 35404 Optics	4	
PHYS/ASTR course numbered 3000 or higher	3	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵	3	
General Electives	2	
PHYS 34503 Electromagnetic Theory I		3
PHYS/ASTR course numbered 3000 or higher		3
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵		3
General Electives		6
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
PHYS 40703 Introduction to Quantum Mechanics	3	
ASTR course numbered 3000 or higher (choose from ASTR 40303, ASTR 40403, ASTR 40703, or ASTR 40803)	3	
University Residency Requirement Electives	1	
General Electives	8	
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes (1.2 and 6.1))		1
ASTR course numbered 3000 or higher (choose from ASTR 40303, ASTR 40403, ASTR 40703, or ASTR 40803)		3
General Electives		11
Year Total:	15	15

Total Units in Sequence: 120

- ¹ Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.
- ² The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.
- ³ The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.
- ⁴ The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.
- ⁵ The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGECE 11003, AGECE 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

Requirement for B.S. Degree with a Major in Physics

University and College Requirements for a Bachelor of Science in Physics: In addition to the Fulbright College of Arts and Sciences Graduation Requirements (see under Degree Completion Program Policy), the following course requirements must be met. **Bolded** courses from the course list below may be applied to portions of the University/state minimum core (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/>) requirements.

University/State Minimum Core 35

Students must complete the following:

PHYS 20304	University Physics I (ACTS Equivalency = PHYS 2034)	4
PHYS 20404	University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
PHYS 20504	University Physics III	4
PHYS 34503	Electromagnetic Theory I	3
PHYS 36103	Modern Physics	3
PHYS 40703	Introduction to Quantum Mechanics	3
PHYS 49901	Physics Senior Seminar ¹	1

Mathematics Courses:

MATH 24004	Calculus I (ACTS Equivalency = MATH 2405)	4
MATH 25004	Calculus II	4
MATH 26004	Calculus III	4
MATH 25804	Elementary Differential Equations	4
MATH 30803	Linear Algebra ²	3

Additional Science

At least 8 hours of other science chosen from: 8

CHEM 14103 & CHEM 14101	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 14203 & CHEM 14201	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 20004	Programming Foundations I	
CSCE 20104	Programming Foundations II	
BIOL 10103 & BIOL 10101	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 10104	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOL 11103 & GEOL 11101	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOL 11203 & GEOL 11201	Earth Science (ACTS Equivalency = GEOL 1124 Lecture) and Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)	
Concentration Requirements		16-24
Physics B.S. majors must complete all the requirements for one of seven available concentration areas. All concentrations consist of 16 credit hours with the exception of the Geophysics concentration, which requires 24.		
University Residency Requirement Electives (See Degree Completion Program Policy)		1
General Electives		11-19
Total Hours		120

¹ Majors must propose participation in a research experience project no later than the end of their junior year of study. A written report of the results must be submitted during Senior Seminar (PHYS 49901).

² CSCE 35103, CSCE 44203, MEEG 27003, or GEOS 42203 can be substituted for MATH 30803 with the adviser's approval.

Biophysics Concentration

PHYS 43303	Thermal Physics	3
PHYS 46103	Introduction to Biophysics and Biophysical Techniques	3
A Junior Level Laboratory Course chosen from PHYS 3610V, PHYS 35404, or PHYS 32103		1-4
6-9 semester hours numbered 3000 and above in physics, astronomy, biology, and chemistry chosen with the adviser's permission.		6-9
Total Hours		16

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/

analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.S. with Biophysics Concentration Eight-Semester Degree Plan

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/>) in the Academic Regulations chapter for university requirements of the program as well as Fulbright College requirements.

University/state minimum core requirements may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute with general electives. Students should consult with their academic advisor.

First Year	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1) ¹	4	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)	4	
Fine Arts State Minimum Core (Satisfies General Education Outcome 3.1) ²	3	
General Electives	1	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 25004 Calculus II		4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)		4
Humanities State Minimum Core (Select a course which satisfies both General Education Outcomes 3.2 and 5.1) ³		3
General Electives		1
Year Total:	15	15

Second Year	Units	
	Fall	Spring
MATH 26004 Calculus III	4	
PHYS 20504 University Physics III	4	
U.S. History or Government State Minimum Core (Satisfies General Education Outcome 4.2)	3	

Select one of the following four-hour science lecture/lab combinations:⁴

CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I

CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab) or an approved four credit hours of other laboratory-based courses from these departments.

MATH 25804 Elementary Differential Equations 4

PHYS 36103 Modern Physics 3

Select one of the following four-hour science lecture/lab combinations:⁴

CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I

CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab) or an approved four credit hours of other laboratory-based courses from these departments.

Social Sciences State Minimum Core (Select a course which satisfies both General Education Outcomes 3.3 and 4.1) ⁵	3	
General Electives		1
Year Total:	15	15

	Units	
	Fall	Spring
Third Year		
MATH 30803 Linear Algebra	3	
A junior-level laboratory course chosen from PHYS 3610L, PHYS 35404, or PHYS 32103	1-4	
PHYS, ASTR, BIOL, or CHEM course numbered 3000 or higher	3	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁶	3	
General Electives	2-5	
PHYS 34503 Electromagnetic Theory I		3
PHYS 43303 Thermal Physics		3
PHYS, ASTR, BIOL, or CHEM course numbered 3000 or higher		3
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁶		3
General Electives		3
Year Total:	15	15

	Units	
	Fall	Spring
Fourth Year		
PHYS 40703 Introduction to Quantum Mechanics	3	
PHYS, ASTR, BIOL, or CHEM course numbered 3000 or higher (if needed). Otherwise, take General Electives.	3	
University Residency Requirement Electives	1	
General Electives	8	
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)		1
PHYS 46103 Introduction to Biophysics and Biophysical Techniques		3
General Electives		11
Year Total:	15	15

Total Units in Sequence: 120

¹ Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

² The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3,

MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

³ The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include:

CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.

⁴ BIOL 10103/BIOL 10101, CHEM 14103/CHEM 14101, and CHEM 14203/CHEM 14201 are highly recommended as they serve as prerequisites for many higher-level BIOL and CHEM courses.

⁵ The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

⁶ The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include:

AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

Requirement for B.S. Degree with a Major in Physics

University and College Requirements for a Bachelor of Science in Physics:

In addition to the Fulbright College of Arts and Sciences Graduation Requirements (see under Degree Completion Program Policy), the following course requirements must be met. **Bolded** courses from the course list below may be applied to portions of the University/state minimum core (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/>) requirements.

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Students must complete the following:	
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PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
PHYS 20504 University Physics III	4
PHYS 34503 Electromagnetic Theory I	3
PHYS 36103 Modern Physics	3
PHYS 40703 Introduction to Quantum Mechanics	3
PHYS 49901 Physics Senior Seminar ¹	1
Mathematics Courses:	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405)	4
MATH 25004 Calculus II	4
MATH 26004 Calculus III	4
MATH 25804 Elementary Differential Equations	4
MATH 30803 Linear Algebra ²	3
Additional Science	
At least 8 hours of other science chosen from:	8

CHEM 14103 University Chemistry I (ACTS Equivalency = & CHEM 14101 CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = & CHEM 14201 CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I

CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL & BIOL 10101 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)

BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL & GEOL 11101 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 & GEOL 11201 Lecture) and Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

Concentration Requirements	16-24
Physics B.S. majors must complete all the requirements for one of seven available concentration areas. All concentrations consist of 16 credit hours with the exception of the Geophysics concentration, which requires 24.	
University Residency Requirement Electives (See Degree Completion Program Policy)	1
General Electives	11-19
Total Hours	120

¹ Majors must propose participation in a research experience project no later than the end of their junior year of study. A written report of the results must be submitted during Senior Seminar (PHYS 49901).

² CSCE 35103, CSCE 44203, MEEG 27003, or GEOS 42203 can be substituted for MATH 30803 with the adviser's approval.

Computational Concentration

PHYS 31103 Analytical Mechanics	3
A Junior Level Laboratory Course chosen from:	1-4
PHYS 3610V Modern Physics Laboratory	
PHYS 35404 Optics	
PHYS 32103 Electronics in Experimental Physics	
9-12 credit hours numbered 3000 or higher in PHYS, ASTR, CSCE, or MATH chosen in consultation with an adviser	
Total Hours	16

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/

analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.S. with Computational Concentration Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/>) in the Academic Regulations chapter for university requirements of the program as well as Fulbright College requirements.

University/state minimum core requirements may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute with general electives. Students should consult with their academic advisers.

	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1) ¹	4	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)	4	
Fine Arts State Minimum Core (Satisfies General Education Outcome 3.1) ²	3	
General Electives	1	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 25004 Calculus II		4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)		4
Humanities State Minimum Core Requirement (Select a course which satisfies both General Education Outcomes 3.2 and 5.1) ³		3
General Electives		1
Year Total:	15	15

	Units	
	Fall	Spring
MATH 26004 Calculus III	4	
PHYS 20504 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations: ⁴	4	

CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)
& CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture)
& CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I
CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)
& BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)
or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture)
& GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)
GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture)
& GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

or an approved four credit hours of other laboratory-based courses from these departments.

U.S. History or Government - State Minimum Core (Satisfies General Education Outcome 4.2) 3

MATH 25804 Elementary Differential Equations 4

PHYS 36103 Modern Physics 3

Select one of the following four-hour science lecture/lab combinations:⁴ 4

CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)
& CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture)
& CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I
CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)
& BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)
or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture)
& GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab) or an approved four credit hours of other laboratory-based courses from these departments.

Social Sciences State Minimum Core (Select a course which satisfies both General Education Outcomes 3.3 and 4.1) ⁵		3
General Electives		1
Year Total:	15	15

Third Year	Units	
	Fall	Spring
MATH 30803 Linear Algebra	3	
PHYS 31103 Analytical Mechanics	3	
A junior-level laboratory course chosen from PHYS 3610V, PHYS 35404, or PHYS 32103	1-4	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁶	3	
General Electives	2-5	
PHYS 34503 Electromagnetic Theory I		3
Any PHYS, ASTR, CSCE, or MATH course numbered 3000 or higher		6
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁶		3
General Electives		3
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
PHYS 40703 Introduction to Quantum Mechanics	3	
Any PHYS, ASTR, CSCE, or MATH course numbered 3000 or higher	3	
University Residency Requirement Electives	1	
General Electives	8	
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)		1
Any PHYS, ASTR, CSCE, or MATH course numbered 3000 or higher (if needed). Otherwise, take General Electives.		3
General Electives		11
Year Total:	15	15

Total Units in Sequence: 120

¹ Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

² The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

- ³ The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.
- ⁴ CSCE 20004 and CSCE 20104 are highly recommended for students who plan to take additional computer science (CSCE) courses.
- ⁵ The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.
- ⁶ The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

Requirement for B.S. Degree with a Major in Physics

University and College Requirements for a Bachelor of Science in Physics:

In addition to the Fulbright College of Arts and Sciences Graduation Requirements (see under Degree Completion Program Policy), the following course requirements must be met. **Bolded** courses from the course list below may be applied to portions of the University/state minimum core (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/>) requirements.

University/State Minimum Core 35

Students must complete the following:

PHYS 20304	University Physics I (ACTS Equivalency = PHYS 2034)	4
PHYS 20404	University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
PHYS 20504	University Physics III	4
PHYS 34503	Electromagnetic Theory I	3
PHYS 36103	Modern Physics	3
PHYS 40703	Introduction to Quantum Mechanics	3
PHYS 49901	Physics Senior Seminar ¹	1

Mathematics Courses:

MATH 24004	Calculus I (ACTS Equivalency = MATH 2405)	4
MATH 25004	Calculus II	4
MATH 26004	Calculus III	4
MATH 25804	Elementary Differential Equations	4
MATH 30803	Linear Algebra ²	3

Additional Science

At least 8 hours of other science chosen from:		8
CHEM 14103	University Chemistry I (ACTS Equivalency = & CHEM 14101CHEM 1414 Lecture)	
	and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	

CHEM 14203 & CHEM 14201	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 20004	Programming Foundations I	
CSCE 20104	Programming Foundations II	
BIOL 10103 & BIOL 10101	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 10104	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOL 11103 & GEOL 11101	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOL 11203 & GEOL 11201	Earth Science (ACTS Equivalency = GEOL 1124 Lecture) and Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)	
Concentration Requirements		16-24
Physics B.S. majors must complete all the requirements for one of seven available concentration areas. All concentrations consist of 16 credit hours with the exception of the Geophysics concentration, which requires 24.		
University Residency Requirement Electives (See Degree Completion Program Policy)		1
General Electives		11-19
Total Hours		120

¹ Majors must propose participation in a research experience project no later than the end of their junior year of study. A written report of the results must be submitted during Senior Seminar (PHYS 49901).

² CSCE 35103, CSCE 44203, MEEG 27003, or GEOS 42203 can be substituted for MATH 30803 with the adviser's approval.

Electronics Concentration

PHYS 32103	Electronics in Experimental Physics (also fulfills Junior Laboratory requirement)	3
PHYS 43303	Thermal Physics	3
10 semester hours numbered 3000 and above in physics or astronomy.		10
Total Hours		16

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed

before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.S. with Electronics Concentration Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/>) in the Academic Regulations chapter for university requirements of the program as well as Fulbright College requirements.

University/state minimum core requirements may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute with general electives. Students should consult with their academic advisors.

First Year	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1) ¹	4	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)	4	
Fine Arts State Minimum Core (Satisfies General Education Outcome 3.1) ²	3	
General Electives	1	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 25004 Calculus II		4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)		4
Humanities State Minimum Core (Select a course which satisfies General Education Outcomes 3.2 and 5.1) ³		3
General Electives		1
Year Total:	15	15

Second Year	Units	
	Fall	Spring
MATH 26004 Calculus III	4	
PHYS 20504 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations:	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I
CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

or an approved four credit hours of other laboratory-based courses from these departments.

U.S. History or Government State Minimum Core (Satisfies General Education Outcome 4.2) 3

MATH 25804 Elementary Differential Equations 4

PHYS 32103 Electronics in Experimental Physics 3

PHYS 36103 Modern Physics 3

Select one of the following four-hour science lecture/lab combinations: 4

CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I
CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

or an approved four credit hours of other laboratory-based courses from these departments.

General Electives		1
Year Total:	15	15

Third Year	Units	
	Fall	Spring
MATH 30803 Linear Algebra	3	
Any PHYS or ASTR course numbered 3000 or higher	3	
Social Sciences State Minimum Core (Select a course which satisfies General Education Outcomes 3.3 and 4.1) ⁴	3	
General Electives	6	
PHYS 34503 Electromagnetic Theory I		3
PHYS 43303 Thermal Physics		3
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵		3
General Electives		6
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
PHYS 40703 Introduction to Quantum Mechanics ^{6,7}	3	
Any PHYS or ASTR course numbered 3000 or higher	4	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵	3	
University Residency Requirement Electives	1	
General Electives	4	
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1) ^{6,7}		1
Any PHYS or ASTR course numbered 3000 or higher		3
General Electives		11
Year Total:	15	15

Total Units in Sequence:	120
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¹ Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

² The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

³ The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.

⁴ The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293,

HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

⁵ The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGECE 11003, AGECE 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

⁶ Meets 40-hour advanced credit hour requirement. See College Academic Regulations.

⁷ Meets 24-hour rule (24 hours of 3000-4000 level courses in Fulbright College), in addition to meeting the 40-hour rule. See College Academic Regulations.

⁸ Any PHYS or ASTR classes numbered 3000 or above.

Requirement for B.S. Degree with a Major in Physics

University and College Requirements for a Bachelor of Science in Physics:

In addition to the Fulbright College of Arts and Sciences Graduation Requirements (see under Degree Completion Program Policy), the following course requirements must be met. **Bolded** courses from the course list below may be applied to portions of the University/state minimum core (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/>) requirements.

University/State Minimum Core **35**

Students must complete the following:

PHYS 20304	University Physics I (ACTS Equivalency = PHYS 2034)	4
PHYS 20404	University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
PHYS 20504	University Physics III	4
PHYS 34503	Electromagnetic Theory I	3
PHYS 36103	Modern Physics	3
PHYS 40703	Introduction to Quantum Mechanics	3
PHYS 49901	Physics Senior Seminar ¹	1

Mathematics Courses:

MATH 24004	Calculus I (ACTS Equivalency = MATH 2405)	4
MATH 25004	Calculus II	4
MATH 26004	Calculus III	4
MATH 25804	Elementary Differential Equations	4
MATH 30803	Linear Algebra ²	3

Additional Science

At least 8 hours of other science chosen from: **8**

CHEM 14103 University Chemistry I (ACTS Equivalency = & CHEM 14101CHEM 1414 Lecture)
and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = & CHEM 14201CHEM 1424 Lecture)
and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSC 20004 Programming Foundations I

CSC 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL & BIOL 10101 1014 Lecture)
and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)

BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL & GEOL 11101 1114 Lecture)
and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 & GEOL 11201 Lecture)
and Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

Concentration Requirements **16-24**

Physics B.S. majors must complete all the requirements for one of seven available concentration areas. All concentrations consist of 16 credit hours with the exception of the Geophysics concentration, which requires 24.

University Residency Requirement Electives (See Degree Completion Program Policy) **1**

General Electives **11-19**

Total Hours **120**

¹ Majors must propose participation in a research experience project no later than the end of their junior year of study. A written report of the results must be submitted during Senior Seminar (PHYS 49901).

² CSC 35103, CSC 44203, MEEG 27003, or GEOS 42203 can be substituted for MATH 30803 with the adviser's approval.

Geophysics Concentration

PHYS 31103	Analytical Mechanics	3
GEOL 11103 & GEOL 11101	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	4
GEOS 23103	Mineralogy	3
GEOS 34103	Sedimentary Geology	3
GEOS 35104	Structural Geology	4
GEOS 42203	Stratigraphy and Sedimentation	3
GEOS 49204	Earth System History	4

Completion of GEOS 4053 Geomorphology, GEOS 4433 Geophysics, and GEOS 4686 Field Camp in addition to the stated requirements for a physics-geophysics major will enable a student to complete the requirements for a double major in physics and geology.

Total Hours **24**

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such

as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.S. Geophysics Concentration Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy in the Academic Regulations chapter for university requirements of the program as well as Fulbright College requirements.

Core requirement hours may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute a three-hour (or more) general elective in place of a core area. Students should consult their advisers.

First Year	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1) ^{1,2}	4	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4) ¹	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	4	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4) ¹		4
MATH 25004 Calculus II ¹		4
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		4
Year Total:	15	15

Second Year	Units	
	Fall	Spring
PHYS 20504 University Physics III ¹	4	
MATH 25804 Elementary Differential Equations ^{1,3}	4	
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	4	
GEOS 23103 Mineralogy	3	
PHYS 36103 Modern Physics ^{1,3}		3

MATH 26004 Calculus III ^{1,3}		4
GEOS 34103 Sedimentary Geology		3
State Minimum Core Social Sciences Requirement (Select a course which satisfies both General Education Outcomes 3.3 and 4.1) ⁴		3
General Elective		2
Year Total:	15	15

Third Year	Units	
	Fall	Spring
PHYS 31103 Analytical Mechanics ³	3	
GEOS 42203 Stratigraphy and Sedimentation	3	
State Minimum Core History or Government Requirement (Satisfies General Education Outcome 4.2)	3	
State Minimum Core Social Sciences Requirement (Satisfies General Education Outcome 3.3) ⁵	3	
General Elective	3	
GEOS 35104 Structural Geology		4
State Minimum Core Social Sciences Requirement (Satisfies General Education Outcome 3.3) ⁵		3
General Electives		8
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
PHYS 40703 Introduction to Quantum Mechanics	3	
GEOS 44303 Geophysics	3	
State Minimum Core Humanities or Fine Arts requirement (as needed) (Select a course which satisfies both General Education Outcomes 3.2 and 5.1 or satisfies 3.1) ^{6,7}	3	
General Electives	6	
PHYS 34503 Electromagnetic Theory I ³		3
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1) ³		1
GEOS 49204 Earth System History		4
State Minimum Core Fine Arts or Humanities Requirement (as needed) (Satisfies General Education Outcome 3.1 or select a course which satisfies both 3.2 and 5.1) ^{7,6}		3
General Electives		4
Year Total:	15	15

Total Units in Sequence: 120

¹ Meets 40-hour advanced credit hour requirement. See College Academic Regulations.

² Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

³ Meets 24-hour rule (24 hours of 3000-4000 level courses in Fulbright College), in addition to meeting the 40-hour rule. See College Academic Regulations.

- ⁴ The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.
- ⁵ The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGECE 11003, AGECE 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.
- ⁶ The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.
- ⁷ The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

Requirement for B.S. Degree with a Major in Physics

University and College Requirements for a Bachelor of Science in Physics: In addition to the Fulbright College of Arts and Sciences Graduation Requirements (see under Degree Completion Program Policy), the following course requirements must be met. **Bolded** courses from the course list below may be applied to portions of the University/state minimum core (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/>) requirements.

University/State Minimum Core	35
Students must complete the following:	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034)	4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
PHYS 20504 University Physics III	4
PHYS 34503 Electromagnetic Theory I	3
PHYS 36103 Modern Physics	3
PHYS 40703 Introduction to Quantum Mechanics	3
PHYS 49901 Physics Senior Seminar ¹	1
Mathematics Courses:	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405)	4
MATH 25004 Calculus II	4
MATH 26004 Calculus III	4
MATH 25804 Elementary Differential Equations	4
MATH 30803 Linear Algebra ²	3
Additional Science	
At least 8 hours of other science chosen from:	8
CHEM 14103 University Chemistry I (ACTS Equivalency = & CHEM 14101CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	

CHEM 14203 University Chemistry II (ACTS Equivalency = & CHEM 14201CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCS 20004 Programming Foundations I	
CSCS 20104 Programming Foundations II	
BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL & BIOL 10101 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL & GEOL 11101 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 & GEOL 11201 Lecture) and Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)	

Concentration Requirements	16-24
Physics B.S. majors must complete all the requirements for one of seven available concentration areas. All concentrations consist of 16 credit hours with the exception of the Geophysics concentration, which requires 24.	
University Residency Requirement Electives (See Degree Completion Program Policy)	1
General Electives	11-19
Total Hours	120

- ¹ Majors must propose participation in a research experience project no later than the end of their junior year of study. A written report of the results must be submitted during Senior Seminar (PHYS 49901).
- ² CSCS 35103, CSCS 44203, MEEG 27003, or GEOS 42203 can be substituted for MATH 30803 with the adviser's approval.

Optics Concentration

PHYS 35404 Optics (fulfills Junior Laboratory requirement)	4
PHYS 47304 Introduction to Laser Physics or PHYS 47703 Introduction to Optical Properties of Materials	3-4
8-9 semester hours (to total 16 hours total for the concentration) numbered 3000 and above in physics or astronomy.	8-9
Total Hours	16

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed

before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.S. with Optics Concentration Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/>) in the Academic Regulations chapter for university requirements of the program as well as Fulbright College requirements.

University/state minimum core requirements may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute with general electives. Students should consult with their academic advisors.

First Year	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1) ¹	4	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)	4	
Fine Arts State Minimum Core (Satisfies General Education Outcome 3.1) ²	3	
General Electives	1	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 25004 Calculus II		4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)		4
Humanities State Minimum Core (Select a course which satisfies both General Education Outcomes 3.2 and 5.1) ³		3
General Electives		1
Year Total:	15	15

Second Year	Units	
	Fall	Spring
MATH 26004 Calculus III	4	
PHYS 20504 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations:	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I

CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)

& BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)

or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture)

& GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture)

& GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

or an approved four credit hours of other laboratory-based courses from these departments.

U.S. History or Government State Minimum Core (Satisfies General Education Outcome 4.2) 3

MATH 25804 Elementary Differential Equations 4

PHYS 36103 Modern Physics 3

Select one of the following four-hour science lecture/lab combinations: 4

CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)

CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)

CSCE 20004 Programming Foundations I

CSCE 20104 Programming Foundations II

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)

& BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)

or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)

GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture)

& GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)

GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture)

& GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)

or an approved four credit hours of other laboratory-based courses from these departments.

Social Sciences State Minimum Core (Select a course which satisfies both General Education Outcomes 3.3 and 4.1) ⁴	3
General Electives	1
Year Total:	15

Third Year	Units	
	Fall	Spring
MATH 30803 Linear Algebra	3	
PHYS 35404 Optics	4	
Any PHYS or ASTR course numbered 3000 or higher	3	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵	3	
General Electives	2	
PHYS 34503 Electromagnetic Theory I	3	
Any PHYS or ASTR course numbered 3000 or higher	3	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵	3	
General Electives	6	
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
PHYS 40703 Introduction to Quantum Mechanics	3	
Any PHYS or ASTR course numbered 3000 or higher	3	
University Residency Requirement Electives	1	
General Electives	8	
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)	1	
PHYS 47304 Introduction to Laser Physics or PHYS 47703 Introduction to Optical Properties of Materials	3-4	
General Electives	10-11	
Year Total:	15	15

Total Units in Sequence: 120

¹ Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.
² The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.
³ The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.
⁴ The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203,

HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

⁵ The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

Requirement for B.S. Degree with a Major in Physics

University and College Requirements for a Bachelor of Science in Physics: In addition to the Fulbright College of Arts and Sciences Graduation Requirements (see under Degree Completion Program Policy), the following course requirements must be met. **Bolded** courses from the course list below may be applied to portions of the University/state minimum core (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/>) requirements.

University/State Minimum Core 35

Students must complete the following:

PHYS 20304	University Physics I (ACTS Equivalency = PHYS 2034)	4
PHYS 20404	University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
PHYS 20504	University Physics III	4
PHYS 34503	Electromagnetic Theory I	3
PHYS 36103	Modern Physics	3
PHYS 40703	Introduction to Quantum Mechanics	3
PHYS 49901	Physics Senior Seminar ¹	1

Mathematics Courses:

MATH 24004	Calculus I (ACTS Equivalency = MATH 2405)	4
MATH 25004	Calculus II	4
MATH 26004	Calculus III	4
MATH 25804	Elementary Differential Equations	4
MATH 30803	Linear Algebra ²	3

Additional Science

At least 8 hours of other science chosen from: 8

CHEM 14103	University Chemistry I (ACTS Equivalency = & CHEM 14101CHEM 1414 Lecture)	
	and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 14203	University Chemistry II (ACTS Equivalency = & CHEM 14201CHEM 1424 Lecture)	
	and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 20004	Programming Foundations I	
CSCE 20104	Programming Foundations II	
BIOL 10103	Principles of Biology (ACTS Equivalency = BIOL & BIOL 10101 1014 Lecture)	
	and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	

BIOL 10104	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOL 11103 & GEOL 11101	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOL 11203 & GEOL 11201	Earth Science (ACTS Equivalency = GEOL 1124 Lecture) and Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)	
Concentration Requirements		16-24
Physics B.S. majors must complete all the requirements for one of seven available concentration areas. All concentrations consist of 16 credit hours with the exception of the Geophysics concentration, which requires 24.		
University Residency Requirement Electives (See Degree Completion Program Policy)		1
General Electives		11-19
Total Hours		120

¹ Majors must propose participation in a research experience project no later than the end of their junior year of study. A written report of the results must be submitted during Senior Seminar (PHYS 49901).

² CSCE 35103, CSCE 44203, MEEG 27003, or GEOS 42203 can be substituted for MATH 30803 with the adviser's approval.

Professional Concentration

PHYS 31103	Analytical Mechanics	3
PHYS 43303	Thermal Physics	3
A Junior Level Laboratory Course chosen from:		1-4
PHYS 3610V	Modern Physics Laboratory	
PHYS 35404	Optics	
PHYS 32103	Electronics in Experimental Physics	
6-9 semester hours numbered 3000 and above in physics or astronomy.		6-9
Total Hours		16

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.S. with Professional Concentration Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://>

catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program as well as Fulbright College requirements.

University/state minimum core requirements may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute with general electives. Students should consult with their academic advisors.

First Year	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1) ¹	4	
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)	4	
Fine Arts State Minimum Core (Satisfies General Education Outcome 3.1) ²	3	
General Electives	1	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 25004 Calculus II		4
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)		4
Humanities State Minimum Core (Select a course which satisfies both General Education Outcomes 3.2 and 5.1) ³		3
General Electives		1
Year Total:	15	15

Second Year	Units	
	Fall	Spring
MATH 26004 Calculus III	4	
PHYS 20504 University Physics III	4	
Select one of the following science four-hour lecture/lab combinations:	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 20004 Programming Foundations I		
CSCE 20104 Programming Foundations II		

BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 10104 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)			
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)			
GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab) or an approved four credit hours of other laboratory-based courses from these departments.			
U.S. History or Government State Minimum Core (Satisfies General Education Outcome 4.2)	3		
MATH 25804 Elementary Differential Equations		4	
PHYS 36103 Modern Physics		3	
Social Sciences State Minimum Core (Select a course which satisfies both General Education Outcomes 3.3 and 4.1) ⁴		3	
Select one of the following four-hour science lecture/lab combinations:		4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 14101 University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)			
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)			
CSCE 20004 Programming Foundations I			
CSCE 20104 Programming Foundations II			
BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)			
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)			
GEOL 11203 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOL 11201 Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab) or an approved four credit hours of other laboratory-based courses from these departments.			
General Electives		1	
Year Total:	15	15	

Third Year	Units	
	Fall	Spring
MATH 30803 Linear Algebra	3	
PHYS 31103 Analytical Mechanics	3	
A junior-level laboratory course chosen from PHYS 3610V, PHYS 35404, or PHYS 32103	1-4	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵	3	
General Electives	2-5	
PHYS 34503 Electromagnetic Theory I		3
PHYS 43303 Thermal Physics		3
Any PHYS or ASTR course numbered 3000 or higher		3
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3) ⁵		3
General Electives		3
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
PHYS 40703 Introduction to Quantum Mechanics	3	
Any PHYS or ASTR course numbered 3000 or higher	3	
General Electives	9	
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)		1
Any PHYS or ASTR course numbered 3000 or higher (if needed). Otherwise, take General Electives.		3
General Electives		11
Year Total:	15	15

Total Units in Sequence: 120

¹ Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

² The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

³ The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.

⁴ The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

⁵ The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGECE 11003, AGECE 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3,

PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 101H3, or SOCI 20103.

Requirements for a Bachelor of Arts in Physics

The following credit hour requirements must be met (see Degree Completion Program Policy (<http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences/>) for additional information).

State minimum core (<https://catalog.uark.edu/undergraduatecatalog/gened/stateminimum/>) requirements may vary by individual, based on placement and previous course credit earned. Once all core requirements are met, students may substitute with general electives in consultation with their academic advisor. **Bolded** courses from the course list below may be applied to portions of the State Minimum Core (<http://catalog.uark.edu/undergraduatecatalog/gened/stateminimum/>) requirements.

This degree is for students desiring a broader program in the arts, sciences, and social sciences while also majoring in physics. This program is recommended for pre-medical, journalism, pre-business, pre-law and other students planning careers in fields for which a physics education would be beneficial. For B.A. students seeking teaching licensure, see the Teacher Licensure Requirements.

State Minimum Core		35
PHYS 20103 & PHYS 20101	College Physics I (ACTS Equivalency = PHYS 2014 Lecture) and College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab)¹	4
	or PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034)	
PHYS 20203 & PHYS 20201	College Physics II (ACTS Equivalency = PHYS 2024 Lecture) and College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab)¹	4
	or PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	
PHYS 36103	Modern Physics	3
PHYS 49901	Physics Senior Seminar	1
Take 12 additional credit hours chosen from any physics (PHYS) or astronomy (ASTR) courses at the 30000-level or above, which must include at least one of the following Junior level labs:		12
PHYS 32103	Electronics in Experimental Physics	
PHYS 35404	Optics	
PHYS 3610V	Modern Physics Laboratory	
Mathematics Requirement:		
MATH 13004	Precalculus Mathematics (ACTS Equivalency = MATH 1305)	3-4
	or MATH 11003 College Algebra (ACTS Equivalency = MATH 1103)	
	or MATH 12003 Plane Trigonometry (ACTS Equivalency = MATH 1203)	
MATH 24004	Calculus I (ACTS Equivalency = MATH 2405)	3-4
	or MATH 22003 Survey of Calculus (ACTS Equivalency = MATH 2203)	
and two additional courses at the 20000-level or above in mathematics or statistics		6-8

Upper-Level Special Emphasis: Take an additional 9 credit hours at the 30000-level or above. Students may choose any courses numbered 30000 level or higher but should choose courses that align with their career goals and interests.²

Any UA-Fayetteville credit hours numbered at the 30000-level or higher

General Electives 31-35

Total Hours 120

- Students who choose University Physics will have additional MATH prerequisites.
- Some courses numbered 3000 level or higher may have prerequisites. Students may use general electives to take any necessary prerequisite courses.

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 4980V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 49901 or any physics or astronomy course numbered 3000 or above. Students electing the last route must obtain approval of the instructor during the first three weeks of the semester. The research/analytical paper should demonstrate competency in the use of word processing software and also at least one computer analytical tool such as a spreadsheet, mathematical or graphics program, or an original program written by the student.

Assessment of Student Learning: In accordance with state, University, and college requirements, all students must have learning assessed before graduation. Students majoring in physics will be assessed in the course PHYS 49901, which must be taken in the year prior to graduation.

Physics B.A. Eight-Semester Degree Plan

Students enrolling in the eight-semester degree plan should review the Eight-Semester Degree Completion Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/>).

State minimum core requirements may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute with general electives in consultation with their academic advisor.

	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1) ¹	3	
MATH 11003 College Algebra (ACTS Equivalency = MATH 1103) (Satisfies General Education Outcome 2.1) ¹	3	
Humanities State Minimum Core (Satisfies General Education Outcomes 3.2 and 4.1) ¹	3	
General Electives ¹	7	
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1) ¹		3
Choose 1:		3-4

MATH 13004 Precalculus Mathematics (ACTS Equivalency = MATH 1305)		
MATH 12003 Plane Trigonometry (ACTS Equivalency = MATH 1203)		
Fine Arts State Minimum Core (Satisfies General Education Outcome 3.1) ¹	3	
Social Science State Minimum Core (Satisfies General Education Outcome 3.3) ¹	3	
General Electives ¹	2-3	
Year Total:	16	15

Second Year		Units
Fall	Spring	

Select one of the following PHYS courses to satisfy General Education Outcome 3.4:		
PHYS 20103 College Physics I (ACTS Equivalency = PHYS 2014 Lecture) & PHYS 20101 College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab) ¹ or PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034)	4	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) or MATH 22003 Survey of Calculus (ACTS Equivalency = MATH 2203)	3-4	
Social Science State Minimum Core (Satisfies General Education Outcome 5.1) ¹	4	
General Electives ¹	3-4	
PHYS 20203 College Physics II (ACTS Equivalency = PHYS 2024 Lecture) & PHYS 20201 College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab) ¹ or PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4	
MATH or STAT 20000+ (MATH 25004 if taking University Physics)	3-4	
Social Science State Minimum Core (Satisfies General Education Outcome 3.3) ¹	3	
General Electives ¹	4-5	
Year Total:	15	15

Third Year		Units
Fall	Spring	

PHYS 36103 Modern Physics	3	
PHYS 3610V Modern Physics Laboratory or PHYS 35404 Optics or PHYS 32103 Electronics in Experimental Physics	1-4	
MATH or STAT 20000+ ¹	3	
U.S. History or Government State Minimum Core (Satisfies General Education Outcome 4.2) ¹	3	
General Electives ¹	2-5	
PHYS or ASTR 30000+	3	
PHYS or ASTR 30000+	3	
Upper-Level Special Emphasis	3	
General Electives ¹	6	

Year Total: 15 15

Fourth Year		Units
Fall	Spring	

PHYS or ASTR 30000+	3	
Upper-Level Special Emphasis	3	
Any UA-Fayetteville credit hours numbered at the 30000-level or higher	3	
General Electives ¹	6	
PHYS 49901 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)		1
PHYS or ASTR 30000+		3
Any UA-Fayetteville credit hours numbered at the 30000-level or higher		2
General Electives (as needed to total 120 degree credits)		8
Year Total:	15	14

Total Units in Sequence: 120

¹ Students must complete the State Minimum Core (<https://catalog.uark.edu/undergraduatecatalog/gened/stateminimum/>) and the requirements of their major(s) as outlined in the Catalog of Studies. These courses also fulfill many, if not all, of the General Education Requirements (<https://nam11.safelinks.protection.outlook.com/?url=http%3A%2F%2Fcatalog.uark.edu%2Fundergraduatecatalog%2Fgened%2Fgeneraleducation%2F&data=04%7C01%7Crc003%40uark.edu%7C92f936f375f845bf930708d8e3ec5fa1%7C79c742c4e61c4fa5be89a3cb566a8%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IjEhaWV%7C1000&sdata=r35av68n3oEQW9FslqBgmbstnUENpJF7EoP4AD4Bks%3D&reserved=0>). Please visit these pages in the links provided and consult with your academic advisor when making course selections to fulfill these requirements.

Requirements for a Minor in Physics: Students wishing to obtain a minor in physics must take either:

Select one of the following: 8

- PHYS 20103 College Physics I (ACTS Equivalency = PHYS & PHYS 20101 2014 Lecture)
& PHYS 20203 and College Physics I Laboratory (ACTS & PHYS 20201 Equivalency = PHYS 2014 Lab)
and College Physics II (ACTS Equivalency = PHYS 2024 Lecture)
and College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab)
- PHYS 20304 University Physics I (ACTS Equivalency = PHYS & PHYS 20404 2034)
and University Physics II (ACTS Equivalency = PHYS 2044 Lecture)

Plus at least seven additional hours of physics courses numbered 3000 or above. 7

Total Hours 15

A student must notify the department of his or her intent to minor.

Requirements for Departmental Honors in Physics: The Departmental Honors Program in Physics provides upper-division undergraduate

students with an opportunity to formally participate in scholarly physics activities. Honors candidates carry out independent study and research under the guidance of the physics faculty and participate in special honors classes, seminars, and colloquia. Outstanding student achievement will be recognized by awarding the distinction "Physics Scholar *Cum Laude*" at graduation. Higher degree distinctions are recommended only in truly exceptional cases and are based upon the whole of the candidate's program of honors studies. In addition to satisfying the general college requirements for the bachelor's degree with honors, an honors candidate in physics must

1. Become a candidate no later than the first semester of the junior year of study,
2. Enroll in honors sections of physics courses when available,
3. Complete a minimum of 12 hours of honors coursework to include:
Six hours of honors research PHYS 399HV and
Three hours of physics honors colloquium PHYS 392H3,
4. Complete and orally defend an honors thesis based upon the project carried out in PHYS 399HV,
5. Achieve a cumulative grade-point average of 3.125 in physics, and
6. Maintain a 3.50 grade-point average overall.

Physics Teacher Licensure Requirements:

Students interested in pursuing a minor in STEM Education (<http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofeducationandhealthprofessions/stemeducation/#minorinstemeducationtext>) or a minor in STEM Education with Secondary Teacher Licensure in mathematics, biology, chemistry, physics, or computer science at the undergraduate level should consult with their assigned academic adviser or find more information at stem.uark.edu (<http://stem.uark.edu/>). Another option to obtain secondary teacher licensure is to complete the one-year Master of Arts in Teaching (<http://catalog.uark.edu/graduatecatalog/programsofstudy/teachereducation/>).

Faculty

Barraza-Lopez, Salvador, Ph.D. (University of Illinois-Urbana-Champaign), B.S. (Instituto Politecnico Nacional de Mexico), Associate Professor, 2011, 2016.

Bellaiche, Laurent, Ph.D., M.S., B.S. (University of Paris VI, France), Distinguished Professor, 1999, 2016.

Churchill, Hugh O.H., Ph.D., A.M. (Harvard University), B.A. (Oberlin College), B.M. (Oberlin Conservatory of Music), Professor, 2015, 2024.

Fu, Huaxiang, Ph.D., M.S. (Fudan University), B.S. (University of Science and Technology of China), Professor, 2002, 2017.

Gea-Banacloche, Julio R., Ph.D. (University of New Mexico), Licenciado en Ciencias Fisicas (Universidad Autonoma de Madrid), Professor, 1989, 2000.

Harter, William G., Ph.D. (University of California-Irvine), B.S. (Hiram College), Professor, 1986.

Hu, Jin, Ph.D. (Tulane University), B.S. (University of Science and Technology of China), Associate Professor, 2017, 2023.

Joffe Minor, Tacy Marie, Ph.D. (Northwestern University), M.A., B.S. (University of Arkansas), Teaching Assistant Professor, 2011, 2018.

Kennefick, Daniel John, Ph.D., M.A. (California Institute of Technology), B.S. (University College Cork, Ireland), Professor, 2003, 2021.

Kennefick, Julia Dusk, Ph.D. (California Institute of Technology), B.S. (University of Arkansas), Professor, 2003, 2024.

Kotekar Patil, Dharmraj, Ph.D. (Eberhard Karls University of Tübingen), Research Assistant Professor, 2022.

Kumar, Pradeep, Ph.D. (Boston University), M.Sc. (Indian Institute of Technology, Mumbai, India), Associate Professor, 2013, 2019.

Leftwich, Matthew, Ph.D., M.S. and B.S. (University of Arkansas), M.B.A. (Webster University), Research Professor, 2021.

Lehmer, Bret Darby, Ph.D. (Pennsylvania State University), B.S. (University of Iowa), Associate Professor, 2015, 2021.

Li, Jiali, Ph.D., M.S. (The City College of the City University of New York), M.S. (University of Science and Technology of China), B.S. (Hei Long Jiang University), Professor, 2002, 2016.

Manasreh, Bothina H., Ph.D., M.Sc. (University of Jordan), Research Associate Professor, 2017, 2022.

Nahas, Youssa, Ph.D. (École Centrale de Paris), M.Sc. (Ecole Normale Supérieure, Paris), B.Sc. (Université Pierre et Marie Curie [Paris VI]), Research Assistant Professor, 2017.

Nakamura, Hiroyuki, Ph.D., M.S., B.S. (University of Tokyo), Assistant Professor, 2019.

Oliver, William F., Ph.D., M.S. (University of Colorado-Boulder), B.S. (University of Arizona), Associate Professor, 1992, 1998.

Pailard, Charles, Ph.D. (Université Paris-Saclay, France), M.Sc., B.Sc. (Université Paris-Sud/École Centrale de Paris), Research Professor, 2023.

Prokhorenko, Sergei, Ph.D. (École Centrale de Paris), M.Sc. (St. Petersburg Academic University), B.Sc. (St. Petersburg Polytechnical University), Research Assistant Professor, 2017.

Prosandeev, Sergey, Ph.D., M.S. (Rostov State University), Research Professor, 2005, 2016.

Salamo, Gregory J., Ph.D. (City University of New York), M.S. (Indiana University-Purdue University-Indianapolis), B.S. (City University of New York, Brooklyn College), Distinguished Professor, 1975, 2005.

Shew, Woodrow L., Ph.D. (University of Maryland-College Park), B.A. (College of Wooster), Associate Professor, 2012, 2017.

Shields, Deanna, Ph.D., M.S. (University of Arkansas), B.S. (University of Houston), Instructor, 2019.

Singh, Surendra P., Ph.D., M.A. (University of Rochester), M.Sc., B.Sc. (Banaras Hindu University, India), University Professor, 1982, 2016.

Skinner, Stephen R., M.S., B.S. (University of Arkansas), Instructor, 1998.

Snyder, Tamara D., M.S. (University of Arkansas), B.S. (University of California-Los Angeles), Teaching Assistant Professor, 2004.

Thibado, Paul M., Ph.D. (University of Pennsylvania), B.S. (San Diego State University), Professor, 1996, 2005.

Vyas, Reeta, Ph.D. (State University of New York at Buffalo), M.S., B.S. (Banaras Hindu University), Professor, 1984, 2002.

Wang, Yong, Ph.D., M.S. (University of California, Los Angeles), B.S. (University of Science and Technology of China), Associate Professor, 2022.

Xiao, Min, Ph.D. (University of Texas at Austin), B.S. (Nanjing University), Distinguished Professor, 1990, 2004.

Astronomy Courses

ASTR 20001. Survey of the Universe Laboratory (ACTS Equivalency = PHSC 1204 Lab). 1 Hour.

Daytime and nighttime observing with telescopes and indoor exercises on selected topics. Pre- or Corequisite: ASTR 20003. (Typically offered: Fall, Spring and Summer)

ASTR 20003. Survey of the Universe (ACTS Equivalency = PHSC 1204 Lecture). 3 Hours.

An introduction to the content and fundamental properties of the cosmos. Topics include planets and other objects of the solar system, the Sun, normal stars and interstellar medium, birth and death of stars, neutron stars, pulsars, black holes, the Galaxy, clusters of galaxies, and cosmology. Corequisite: ASTR 20001 or ASTR 200H1. (Typically offered: Fall, Spring and Summer)

ASTR 200H1. Honors Survey of the Universe Laboratory. 1 Hour.

An introduction to the content and fundamental properties of the cosmos. Topics include planets and other objects of the solar system, the sun, normal stars and interstellar medium, birth and death of stars, neutron stars, and black holes. Pre- or Corequisite: ASTR 20003 or ASTR 200H3. (Typically offered: Fall)

ASTR 200H3. Honors Survey of the Universe. 3 Hours.

An introduction to the content and fundamental properties of the cosmos. Topics include planets and other objects of the solar system, the Sun, normal stars and interstellar medium, birth and death of stars, neutron stars, pulsars, black holes, the Galaxy, clusters of galaxies, and cosmology. Corequisite: ASTR 200H1. (Typically offered: Fall)

ASTR 40303. Astrophysics I: Stars and Planetary Systems. 3 Hours.

An introduction to astrophysics covering stellar structure and evolution, the properties of the solar system, and extrasolar planetary systems. Prerequisite: PHYS 36103 or CHEM 35004. (Typically offered: Fall Odd Years)

ASTR 40403. Astrophysics II: Galaxies and the Large-Scale Universe. 3 Hours.

An introduction to astrophysics covering the interstellar medium, the Milky Way galaxy, extragalactic astronomy, and introduction to cosmology. Prerequisite: ASTR 40303. (Typically offered: Spring Even Years)

ASTR 40703. Cosmology. 3 Hours.

An introduction to modern Big Bang cosmology. The course covers the origin, evolution, and structure of the Universe, based on the Theory of Relativity. Prerequisite: PHYS 36103 or CHEM 35004. (Typically offered: Spring Odd Years)

ASTR 40803. Data Analysis and Computing in Astronomy. 3 Hours.

Study of the statistical analysis of large data sets that are prevalent in the physical sciences with an emphasis on astronomical data and problems. Includes computational lab 1 hour per week. Corequisite: Lab component. Prerequisite: PHYS 36103. (Typically offered: Fall Even Years)

Physics Courses

PHYS 10241. Physics and Human Affairs Laboratory. 1 Hour.

Laboratory 2 hours per week. Pre- or Corequisite: PHYS 10243. (Typically offered: Fall, Spring and Summer)

PHYS 10243. Physics and Human Affairs. 3 Hours.

The great ideas of physics, together with their philosophical and social impact. Scientific topics include cosmology, relativity, quantum mechanics. Philosophical and social topics include methods and values of science, problems related to energy sources, and implications of modern weapons. Non-mathematical. Designed for non-science majors. Along with PHYS 10241, can be used to satisfy a 4-year physical science requirement for a B.A. degree. Students who have received credit in PHYS 20103 and PHYS 20203, or PHYS 20304 and PHYS 20404 cannot also receive degree credit in this course. Corequisite: PHYS 10241. (Typically offered: Fall, Spring and Summer)

PHYS 102H1. Honors Physics and Human Affairs Laboratory. 1 Hour.

Laboratory 2 hours per week. Pre- or Corequisite: PHYS 102H3. (Typically offered: Fall, Spring and Summer)

PHYS 102H3. Honors Physics and Human Affairs. 3 Hours.

The great ideas of physics, together with their philosophical and social impact. Scientific topics include cosmology, relativity, quantum mechanics. Philosophical and social topics include methods and values of science, problems related to energy sources, and implications of modern weapons. Non-mathematical. Designed for non-science majors. Along with PHYS 10241, can be used to satisfy a 4-year physical science requirement for a B.A. degree. Students who have received credit in PHYS 20103 and PHYS 20203, or PHYS 20304 and PHYS 20404 cannot also receive degree credit in this course. Corequisite: PHYS 102H1. (Typically offered: Fall, Spring and Summer)

PHYS 10304. Physics for Elementary Education Majors. 4 Hours.

For elementary education majors. Physical science concepts based on state frameworks are explored in a mixed lecture/lab environment. The inquiry-based lab activities can be transferable for school classroom use. Topics covered include: scientific inquiry, motion and forces, conservation of energy, heat, light, electricity and simple circuits, and magnetism. Prerequisite: Elementary education major. Corequisite: Lab component. (Typically offered: Spring)

PHYS 10404. Physics for Architects I. 4 Hours.

Algebra-based survey of physics principles including motion, force, torque, and oscillation with emphasis on architectural structural support systems. Topics include physical units, coordinates, vectors, velocity, acceleration, projectile motion, catalog of forces, free-body diagrams, rotational motion, torque, center of gravity, impulse, oscillations, static equilibrium, stability, balance, stress, strain, and material strength. Corequisite: Lab component. Prerequisite: Major in architecture or interior design or agricultural education communication & technology. (Typically offered: Fall)

PHYS 10504. Physics for Architects II. 4 Hours.

Algebra-based survey of physics principles including energy, heat, acoustics, light, and electricity with emphasis on interior architectural design. Topics include kinetic and thermal energy, heat transfer, insulation, sound intensity and loudness, sound transmission loss, reverberation time, ray optics, spherical mirror images, household electricity, parallel and series circuits, and electrical safety. Corequisite: Lab component. Prerequisite: Major in architecture or interior design or agricultural education communication & technology. (Typically offered: Spring)

PHYS 20101. College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab). 1 Hour.

Laboratory 2 hours per week. Corequisite: PHYS 20103. (Typically offered: Fall and Summer)

PHYS 20103. College Physics I (ACTS Equivalency = PHYS 2014 Lecture). 3 Hours.

A non-calculus survey of the principles of physics including mechanics, heat and sound. Lecture 3 hours per week and drill 1 hour per week. Corequisite: Drill component and PHYS 20101. Prerequisite: (MATH 11003 and MATH 12003) or (MATH 13004 or MATH 22003 or MATH 24004) or a score of at least 26 on the math component of the ACT exam, or a score of at least 600 on the math component of the old SAT, or 620 on the math component of the new SAT. (Typically offered: Fall and Summer)

PHYS 20201. College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab). 1 Hour.

Laboratory 2 hours per week. Corequisite: PHYS 20203. (Typically offered: Summer)

PHYS 20203. College Physics II (ACTS Equivalency = PHYS 2024 Lecture). 3 Hours.

Continuation of PHYS 20103. Topics include electricity and magnetism, light, relativity, quantum mechanics, atomic and nuclear structure. Lecture 3 hours, drill 1 hour per week. Corequisite: Drill component and PHYS 20201. Prerequisite: PHYS 20103 or PHYS 20304 or PHYS 203H4. (Typically offered: Spring and Summer)

PHYS 20304. University Physics I (ACTS Equivalency = PHYS 2034). 4 Hours.

Introduction to the principles of mechanics, wave motion, temperature and heat, with calculus. Lecture three hours per week and practicum two hours a week (included in lab component). Corequisite: Lab component. Prerequisite: MATH 24004 excluding PHYS majors. Pre- or corequisite: MATH 24004 for PHYS majors. (Typically offered: Fall, Spring and Summer)

PHYS 203H4. Honors University Physics I. 4 Hours.

Introduction to the principles of mechanics, wave motion, temperature and heat, with calculus. Lecture three hours per week and practicum two hours a week (included in lab component). Corequisite: Lab component. Prerequisite: MATH 24004. (Typically offered: Fall, Spring and Summer)

PHYS 20404. University Physics II (ACTS Equivalency = PHYS 2044 Lecture). 4 Hours.

Continuation of PHYS 20304. Topics covered include electricity, magnetism, light and geometric optics. Lecture three hours per week and practicum two hours per week. Corequisite: Lab component. Prerequisite: PHYS 20304 and MATH 25004 (excluding PHYS majors). Pre- or corequisite: MATH 25004 for PHYS majors. (Typically offered: Fall, Spring and Summer)

PHYS 204H4. Honors University Physics II. 4 Hours.

Continuation of PHYS 205H4. Topics covered include electricity, magnetism, light and geometric optics. Lecture three hours per week and practicum two hours per week. Corequisite: Lab component. Prerequisite: (PHYS 20304 or PHYS 203H4) and MATH 25004. (Typically offered: Spring)

PHYS 20504. University Physics III. 4 Hours.

A continuation of PHYS 20304 and PHYS 20404. Topics include waves, physical optics, thermodynamics, kinetic theory, and an introduction to quantum mechanics. Lecture 3 hours per week and practicum 2 hours per week (included in lab component). Pre- or Corequisite: MATH 26004. Corequisite: Lab component. Prerequisite: PHYS 20404. (Typically offered: Fall)

PHYS 3060V. Projects. 1-3 Hour.

Individual experimental or theoretical research problems for advanced undergraduates. Prerequisite: Instructor consent. (Typically offered: Irregular) May be repeated for up to 3 hours of degree credit.

PHYS 31103. Analytical Mechanics. 3 Hours.

Newton's laws of motion applied to particles, systems of particles, and rigid bodies. Introduction to Hamilton's and Lagrange's equations. Pre- or Corequisite: MATH 25804. (Typically offered: Fall)

PHYS 32103. Electronics in Experimental Physics. 3 Hours.

DC & AC electronics, semiconductors, operational amplifiers, and digital logic circuits with lab applications in experimental physics. Corequisite: Lab component. Prerequisite: PHYS 20504 or instructor consent. (Typically offered: Spring Odd Years)

PHYS 32703. Inquiry and Modeling in Science Education. 3 Hours.

Study of science practices with emphasis on modeling and inquiry for learning/teaching. Includes practical, philosophical, cognitive, and disciplinary specific dimensions of doing science in academic and nonacademic settings. Includes planning and implementing multiple scientific inquiries, engaging in reflective practices, writing and presenting scientific information. Safety and ethical issues are included. Corequisite: Drill component. Prerequisite: 8 hours of PHYS courses. (Typically offered: Fall and Spring)

This course is cross-listed with PHYS 3273, CHEM 3273, BIOL 3273.

PHYS 34503. Electromagnetic Theory I. 3 Hours.

Basics of Electromagnetic Theory, focusing on statics and introducing Maxwell's equations. Topics covered are: vector calculus and the solution of partial differential equations by separation of variables, electrostatics, dielectric media, electric currents, magnetic fields, magnetic properties of matter, electromagnetic induction, force and energy in electrodynamics, and Maxwell's equations. Pre- or Corequisite: MATH 25804. Prerequisite: MATH 26004 and PHYS 20404. (Typically offered: Spring)

PHYS 34603. Electromagnetic Theory II. 3 Hours.

Basics of Electromagnetic Theory, focusing on dynamical aspects. Topics to be covered include: Time-varying electric and magnetic fields including propagation of electromagnetic plane waves in vacuum and in matter, reflection, refraction, and guided wave propagation, radiation from point charges and dipoles, and relativity and the relativistic formulation of electrodynamics. Prerequisite: PHYS 34503. (Typically offered: Fall)

PHYS 35404. Optics. 4 Hours.

Elements of geometrical, physical, and quantum optics. Lecture 3 hours, laboratory 2 hours. Corequisite: Lab component. Prerequisite: PHYS 20404 and MATH 25004. (Typically offered: Fall)

PHYS 36003. Introduction to Modern Physics. 3 Hours.

An introduction to the basic ideas of 20th century physics, with an emphasis on those that form the foundations of modern technology: quantum theory and its application to atomic, nuclear, optical and condensed matter physics. No credit is given toward a B.S. degree in physics. Prerequisite: PHYS 20203 and MATH 22003 or MATH 24004. (Typically offered: Fall)

PHYS 36103. Modern Physics. 3 Hours.

Introduction to special relativity, statistical physics, quantum physics, and a survey of molecules, solids, and statistical physics. Prerequisite: PHYS 20404. (Typically offered: Fall, Spring and Summer)

PHYS 3610V. Modern Physics Laboratory. 1-3 Hour.

Advanced experiments, projects, and techniques in atomic, nuclear, and solid state physics. Pre- or corequisite: PHYS 36103. (Typically offered: Fall) May be repeated for up to 3 hours of degree credit.

PHYS 3620V. Introduction to Modern Physics Laboratory. 1-3 Hour.

Experiments illustrating the development and concepts of modern physics. No credit given toward a B.S. major in physics. Prerequisite: PHYS 36003. (Typically offered: Fall)

PHYS 392H3. Honors Colloquium. 3 Hours.

Covers a special topic or issue, offered as part of the honors program. No more than 3 hours may be offered toward fulfillment of the requirements for the B.S. or B.A. degree in Physics. Prerequisite: Honors candidacy (not restricted to candidacy in physics). (Typically offered: Spring) May be repeated for degree credit.

PHYS 399HV. Honors. 1-6 Hour.

Independent study for physics students enrolled in the honors program. Prerequisite: Junior standing. (Typically offered: Fall, Spring and Summer) May be repeated for up to 6 hours of degree credit.

PHYS 40703. Introduction to Quantum Mechanics. 3 Hours.

A survey of quantum mechanics from the wave mechanical point of view including the application of quantum mechanics to the simple harmonic oscillator, angular momentum, and the hydrogen atom. Required course for B.S. Physics majors. Prerequisite: PHYS 36103, MATH 26004, and MATH 25804. (Typically offered: Fall)

PHYS 40803. Advanced Quantum Mechanics. 3 Hours.

Advanced topics in introductory quantum mechanics including identical particles, approximation methods; time-independent perturbations theory, variational principle, time-dependent perturbations theory, and scattering. Prerequisite: PHYS 40703, MATH 26004, and MATH 25804. (Typically offered: Spring)

PHYS 41103. Physics in Perspective. 3 Hours.

Human implications of physics, including life's place in the universe, the methods of science, human sense perceptions, energy utilization, social impacts of technology, and the effect of physics on modern world views. Prerequisite: PHYS 36103.

(Typically offered: Irregular)

PHYS 42103. Physics of Devices. 3 Hours.

Principles of physics applied in a selection of technologically important devices in areas including computing, communications, medical imaging, lasers, and energy utilization. Students will utilize technical journals. Prerequisite: PHYS 36103.

(Typically offered: Irregular)

PHYS 43303. Thermal Physics. 3 Hours.

Equilibrium thermodynamics, statistical physics, and kinetic energy. Prerequisite: PHYS 36103. (Typically offered: Spring)

PHYS 46103. Introduction to Biophysics and Biophysical Techniques. 3 Hours.

Origins of biophysics, biological polymers and polymer physics, properties of DNA and proteins, techniques to study DNA and proteins, biological membrane and ion channels, biological energy, experimental techniques to study single DNA and proteins. Two experiments are included: (1) DNA Gel electrophoresis; (2) Measurement of double-stranded DNA melting point. Prerequisite: PHYS 36103 or consent. (Typically offered: Spring)

PHYS 46503. Subatomic Physics. 3 Hours.

Nuclear structure and nuclear reactions. Nature and properties of elementary particles and resonances, their interactions and decays. Phenomenological theory and discussion of experimental evidence. Prerequisite: PHYS 36103. (Typically offered: Fall Odd Years)

PHYS 47103. Solid State Physics. 3 Hours.

Crystal structure, diffraction and symmetry. Lattice vibrations, elasticity and optical properties. Electronic structure, band theory, transport and magnetism. Course emphasizes applications and current topics in semiconductors, optics and magnetism. Pre- or Corequisite: PHYS 40703. (Typically offered: Spring Even Years)

PHYS 47304. Introduction to Laser Physics. 4 Hours.

A combined lecture/laboratory course covering the theory of laser operation, laser resonators, propagation of laser beams, specific lasers such as gas, solid state, semiconductor and chemical lasers, and laser applications. Prerequisite: PHYS 35404. (Typically offered: Spring)

PHYS 47703. Introduction to Optical Properties of Materials. 3 Hours.

A course covering crystal symmetry optical transmission and absorption, light scattering (Raman and Brillouin) optical constants, carrier mobility, and polarization effects in semi-conductors, quantum wells, insulators, and other optically important materials. Prerequisite: PHYS 35404. (Typically offered: Spring)

PHYS 4880V. Selected Topics in Physics. 1-3 Hour.

Selected topics in experimental or theoretical physics at the advanced level. (Typically offered: Irregular) May be repeated for up to 9 hours of degree credit.

PHYS 4980V. Senior Thesis. 1-6 Hour.

Senior Thesis. (Typically offered: Fall, Spring and Summer)

PHYS 49901. Physics Senior Seminar. 1 Hour.

Student mastery of the principles of physics are assessed by means of a research paper, a presentation on the research topic, and a reflection essay over coursework completed as part of the physics degree. A quantitative assessment examination will also be administered. Satisfies the Fulbright College writing requirement. (Typically offered: Fall, Spring and Summer)