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 2054	**University Physics I (ACTS Equivalency = PHYS 2034)**	**4**
PHYS 2074	**University Physics II (ACTS Equivalency = PHYS 2044 Lecture)**	**4**
PHYS 2094	University Physics III	4
PHYS 3453	Electromagnetic Theory I	3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4991	Physics Senior Seminar [1]	1
Mathematics Courses:		
MATH 2554	**Calculus I (ACTS Equivalency = MATH 2405)**	**4**
MATH 2564	Calculus II (ACTS Equivalency = MATH 2505)	4
MATH 2574	Calculus III (ACTS Equivalency = MATH 2603)	4
MATH 2584	Elementary Differential Equations	4
MATH 3083	Linear Algebra [2]	3
Additional Science		
At least 8 hours of other science chosen from:		8
CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004	Programming Foundations I	
CSCE 2014	Programming Foundations II	
BIOL 1543 & BIOL 1541L	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 1584	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 & GEOS 1131L	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 4991).

[2] CSCE 3513, CSCE 4423, MEEG 2703, or GEOS 4223 can be substituted for MATH 3083 with the adviser's approval.

Astronomy Concentration

PHYS 3544	Optics	4
6 semester hours of ASTR courses numbered 3000 or above (ASTR 4033, ASTR 4043, ASTR 4073, ASTR 4083)		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 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, 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	Units Spring
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
PHYS 2054 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 1023 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		4
PHYS 2074 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	Units Spring
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603)	4	
PHYS 2094 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations:	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 2584 Elementary Differential Equations		4
PHYS 3613 Modern Physics		3
Select one of the following four-hour lecture/lab combinations		4
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		

BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1111L 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 3083 Linear Algebra	3	
PHYS 3544 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 3453 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 4073 Introduction to Quantum Mechanics	3	
ASTR course numbered 3000 or higher (choose from ASTR 4033, ASTR 4043, ASTR 4073, or ASTR 4083)	3	
University Residency Requirement Electives	1	
General Electives	8	
PHYS 4991 Physics Senior Seminar (Satisfies General Education Outcomes (1.2 and 6.1)		1
ASTR course numbered 3000 or higher (choose from ASTR 4033, ASTR 4043, ASTR 4073, or ASTR 4083)		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 2554.

[2] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[3] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[4] The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[5] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

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 2054	**University Physics I (ACTS Equivalency = PHYS 2034)**	**4**
PHYS 2074	**University Physics II (ACTS Equivalency = PHYS 2044 Lecture)**	**4**
PHYS 2094	University Physics III	4
PHYS 3453	Electromagnetic Theory I	3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4991	Physics Senior Seminar [1]	1
Mathematics Courses:		
MATH 2554	**Calculus I (ACTS Equivalency = MATH 2405)**	**4**
MATH 2564	Calculus II (ACTS Equivalency = MATH 2505)	4
MATH 2574	Calculus III (ACTS Equivalency = MATH 2603)	4
MATH 2584	Elementary Differential Equations	4
MATH 3083	Linear Algebra [2]	3
Additional Science		
At least 8 hours of other science chosen from:		8

CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004	Programming Foundations I	
CSCE 2014	Programming Foundations II	
BIOL 1543 & BIOL 1541L	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 1584	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 & GEOS 1131L	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 4991).

[2] CSCE 3513, CSCE 4423, MEEG 2703, or GEOS 4223 can be substituted for MATH 3083 with the adviser's approval.

Biophysics Concentration

PHYS 4333	Thermal Physics	3
PHYS 4613	Introduction to Biophysics and Biophysical Techniques	3
A Junior Level Laboratory Course chosen from PHYS 361VL, PHYS 3544, or PHYS 3213		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 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, 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 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
PHYS 2054 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 1023 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		4
PHYS 2074 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 2574 Calculus III (ACTS Equivalency = MATH 2603)	4	
PHYS 2094 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]	4
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004 Programming Foundations I	
CSCE 2014 Programming Foundations II	
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L Earth Science Laboratory (ACTS Equivalency = GEOL 1124 Lab)	
or an approved four credit hours of other laboratory-based courses from these departments.	
MATH 2584 Elementary Differential Equations	4
PHYS 3613 Modern Physics	3
Select one of the following four-hour science lecture/lab combinations:[4]	4
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004 Programming Foundations I	
CSCE 2014 Programming Foundations II	
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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

Third Year	Fall	Spring
MATH 3083 Linear Algebra	3	
A junior-level laboratory course chosen from PHYS 361VL, PHYS 3544, or PHYS 3213	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 3453 Electromagnetic Theory I		3
PHYS 4333 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

Fourth Year	Fall	Spring
PHYS 4073 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 4991 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)		1
PHYS 4613 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 2554.

[2] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[3] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include:
CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[4] BIOL 1543/BIOL 1541L, CHEM 1103/CHEM 1101L, and CHEM 1123/CHEM 1121L 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 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[6] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include:
AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603,HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013,HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013,INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

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

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PHYS 2074	**University Physics II (ACTS Equivalency = PHYS 2044 Lecture)**	**4**
PHYS 2094	University Physics III	4
PHYS 3453	Electromagnetic Theory I	3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4991	Physics Senior Seminar [1]	1
Mathematics Courses:		
MATH 2554	**Calculus I (ACTS Equivalency = MATH 2405)**	**4**
MATH 2564	Calculus II (ACTS Equivalency = MATH 2505)	4
MATH 2574	Calculus III (ACTS Equivalency = MATH 2603)	4
MATH 2584	Elementary Differential Equations	4
MATH 3083	Linear Algebra [2]	3
Additional Science		
At least 8 hours of other science chosen from:		8
CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004	Programming Foundations I	
CSCE 2014	Programming Foundations II	
BIOL 1543 & BIOL 1541L	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 1584	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 & GEOS 1131L	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 4991).

[2] CSCE 3513, CSCE 4423, MEEG 2703, or GEOS 4223 can be substituted for MATH 3083 with the adviser's approval.

Computational Concentration

PHYS 3113	Analytical Mechanics	3
A Junior Level Laboratory Course chosen from:		1-4
PHYS 361VL	Modern Physics Laboratory	
PHYS 3544	Optics	
PHYS 3213	Electronics in Experimental Physics	
9-12 credit hours numbered 3000 or higher in PHYS, ASTR, CSCE, or MATH chosen in consultation with an adviser		9-12
Total Hours		**16**

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, which must be taken in the year prior to graduation.

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

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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.

First Year	Units Fall	Units Spring
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
PHYS 2054 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 1023 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		4
PHYS 2074 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

Second Year	Units Fall	Units Spring
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603)	4	
PHYS 2094 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations:[4]	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 2584 Elementary Differential Equations		4
PHYS 3613 Modern Physics		3
Select one of the following four-hour science lecture/lab combinations:[4]		4
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		

GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 3083 Linear Algebra	3	
PHYS 3113 Analytical Mechanics	3	
A junior-level laboratory course chosen from PHYS 361VL, PHYS 3544, or PHYS 3213	1-4	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3)[6]	3	
General Electives	2-5	
PHYS 3453 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 4073 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 4991 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 2554.

[2] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003,LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[3] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[4] CSCE 2004 and CSCE 2014 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 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[6] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603,HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

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 2054	**University Physics I (ACTS Equivalency = PHYS 2034)**	**4**
PHYS 2074	**University Physics II (ACTS Equivalency = PHYS 2044 Lecture)**	**4**
PHYS 2094	University Physics III	4
PHYS 3453	Electromagnetic Theory I	3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4991	Physics Senior Seminar [1]	1
Mathematics Courses:		
MATH 2554	**Calculus I (ACTS Equivalency = MATH 2405)**	**4**
MATH 2564	Calculus II (ACTS Equivalency = MATH 2505)	4
MATH 2574	Calculus III (ACTS Equivalency = MATH 2603)	4
MATH 2584	Elementary Differential Equations	4
MATH 3083	Linear Algebra [2]	3
Additional Science		
At least 8 hours of other science chosen from:		8
CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004	Programming Foundations I	

CSCE 2014	Programming Foundations II	
BIOL 1543 & BIOL 1541L	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 1584	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 & GEOS 1131L	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 4991).

[2] CSCE 3513, CSCE 4423, MEEG 2703, or GEOS 4223 can be substituted for MATH 3083 with the adviser's approval.

Electronics Concentration

PHYS 3213	Electronics in Experimental Physics (also fulfills Junior Laboratory requirement)	3
PHYS 4333	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 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, 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	Units Spring
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
PHYS 2054 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 1023 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		4
PHYS 2074 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	Units Spring
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603)	4	
PHYS 2094 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations:	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		

CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 2584 Elementary Differential Equations		4
PHYS 3213 Electronics in Experimental Physics		3
PHYS 3613 Modern Physics		3
Select one of the following four-hour science lecture/lab combinations:		4
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 3083 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 3453 Electromagnetic Theory I		3
PHYS 4333 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 4073 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 4991 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**

[1] Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 2554.

[2] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[3] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include:
CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[4] The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813,

INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[5] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[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 2054	**University Physics I (ACTS Equivalency = PHYS 2034)**	**4**
PHYS 2074	**University Physics II (ACTS Equivalency = PHYS 2044 Lecture)**	**4**
PHYS 2094	University Physics III	4
PHYS 3453	Electromagnetic Theory I	3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4991	Physics Senior Seminar [1]	1
Mathematics Courses:		
MATH 2554	**Calculus I (ACTS Equivalency = MATH 2405)**	**4**
MATH 2564	Calculus II (ACTS Equivalency = MATH 2505)	4
MATH 2574	Calculus III (ACTS Equivalency = MATH 2603)	4
MATH 2584	Elementary Differential Equations	4
MATH 3083	Linear Algebra [2]	3
Additional Science		
At least 8 hours of other science chosen from:		8
CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004	Programming Foundations I	
CSCE 2014	Programming Foundations II	
BIOL 1543 & BIOL 1541L	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 1584	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 & GEOS 1131L	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 4991).

[2] CSCE 3513, CSCE 4423, MEEG 2703, or GEOS 4223 can be substituted for MATH 3083 with the adviser's approval.

Geophysics Concentration

PHYS 3113	Analytical Mechanics	3
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	4
GEOS 2313	Mineralogy	3
GEOS 3413	Sedimentary Geology	3
GEOS 3514	Structural Geology	4
GEOS 4223	Stratigraphy and Sedimentation	3
GEOS 4924	Earth System History (ACTS Equivalency = PHSC 1104)	4
Completion of GEOG 3383 Principles of Landscape Evolution and GEOL 4666 Geology 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 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, 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	Summer
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3		
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1, 2]	4		
PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)[1]	4		
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	4		
ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3	
PHYS 2074 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)[1]		4	
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)[1]		4	
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		4	
Year Total:	15	15	

Second Year			Units
	Fall	Spring	Summer
PHYS 2094 University Physics III[1]	4		
MATH 2584 Elementary Differential Equations[1,3]	4		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	4		
GEOS 2313 Mineralogy	3		
PHYS 3613 Modern Physics[1,3]		3	
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603)[1,3]		4	
GEOS 3413 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		1	
Year Total:	15	14	

Third Year			Units
	Fall	Spring	Summer
PHYS 3113 Analytical Mechanics[3]	3		
GEOS 4223 Stratigraphy and Sedimentation	3		
GEOS 3383	3		
State Minimum Core History or Government Requirement (Satisfies General Education Outcome 4.2)	3		
State Minnimum Core Social Sciences Requirement (Satisfies General Education Outcome 3.3)[5]	3		
GEOS 3514 Structural Geology		4	
State Minimum Core Social Sciences Requirement (Satisfies General Education Outcome 3.3)[5]		3	
General Electives		6	
GEOS 4686 Geology Field Camp[3]			6
Year Total:	15	13	6

Fourth Year			Units
	Fall	Spring	Summer
PHYS 4073 Introduction to Quantum Mechanics	3		
GEOS 4433 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	3		
PHYS 3453 Electromagnetic Theory I[3]		3	
PHYS 4991 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)[3]		1	
GEOS 4924 Earth System History (ACTS Equivalency = PHSC 1104)		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:	12	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 2554.

[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 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[5] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[6] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[7] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

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 2054	**University Physics I (ACTS Equivalency = PHYS 2034)**	**4**
PHYS 2074	**University Physics II (ACTS Equivalency = PHYS 2044 Lecture)**	**4**
PHYS 2094	University Physics III	4
PHYS 3453	Electromagnetic Theory I	3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4991	Physics Senior Seminar [1]	1
Mathematics Courses:		
MATH 2554	**Calculus I (ACTS Equivalency = MATH 2405)**	**4**
MATH 2564	Calculus II (ACTS Equivalency = MATH 2505)	4
MATH 2574	Calculus III (ACTS Equivalency = MATH 2603)	4
MATH 2584	Elementary Differential Equations	4
MATH 3083	Linear Algebra [2]	3
Additional Science		
At least 8 hours of other science chosen from:		8
CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004	Programming Foundations I	
CSCE 2014	Programming Foundations II	
BIOL 1543 & BIOL 1541L	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 1584	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 & GEOS 1131L	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 4991).

[2] CSCE 3513, CSCE 4423, MEEG 2703, or GEOS 4223 can be substituted for MATH 3083 with the adviser's approval.

Optics Concentration

PHYS 3544	Optics (fulfills Junior Laboratory requirement)	4
PHYS 4734	Introduction to Laser Physics	3-4
or PHYS 4773	Introduction to Optical Properties of Materials	

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 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, 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	Units Spring
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
PHYS 2054 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 1023 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		4
PHYS 2074 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	Units Spring
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603)	4	
PHYS 2094 University Physics III	4	
Select one of the following four-hour science lecture/lab combinations:	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 2584 Elementary Differential Equations		4
PHYS 3613 Modern Physics		3
Select one of the following four-hour science lecture/lab combinations:		4
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		

BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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	15

Third Year		Units
	Fall	Spring
MATH 3083 Linear Algebra	3	
PHYS 3544 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 3453 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 4073 Introduction to Quantum Mechanics	3	
Any PHYS or ASTR course numbered 3000 or higher	3	
University Residency Requirement Electives	1	
General Electives	8	
PHYS 4991 Physics Senior Seminar (Satisfies General Education Outcomes 1.2 and 6.1)		1
PHYS 4734 Introduction to Laser Physics or PHYS 4773 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 2554.

[2] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[3] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[4] The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[5] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

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 2054	**University Physics I (ACTS Equivalency = PHYS 2034)**	**4**
PHYS 2074	**University Physics II (ACTS Equivalency = PHYS 2044 Lecture)**	**4**
PHYS 2094	University Physics III	4
PHYS 3453	Electromagnetic Theory I	3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4991	Physics Senior Seminar [1]	1
Mathematics Courses:		
MATH 2554	**Calculus I (ACTS Equivalency = MATH 2405)**	**4**
MATH 2564	Calculus II (ACTS Equivalency = MATH 2505)	4
MATH 2574	Calculus III (ACTS Equivalency = MATH 2603)	4
MATH 2584	Elementary Differential Equations	4
MATH 3083	Linear Algebra [2]	3
Additional Science		

At least 8 hours of other science chosen from:		8
CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	
CSCE 2004	Programming Foundations I	
CSCE 2014	Programming Foundations II	
BIOL 1543 & BIOL 1541L	Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	
BIOL 1584	Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)	
GEOS 1113 & GEOS 1111L	Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)	
GEOS 1133 & GEOS 1131L	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 4991).

[2] CSCE 3513, CSCE 4423, MEEG 2703, or GEOS 4223 can be substituted for MATH 3083 with the adviser's approval.

Professional Concentration

PHYS 3113	Analytical Mechanics	3
PHYS 4333	Thermal Physics	3
A Junior Level Laboratory Course chosen from:		1-4
PHYS 361VL	Modern Physics Laboratory	
PHYS 3544	Optics	
PHYS 3213	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 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, 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 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
PHYS 2054 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 1023 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1)		3
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		4
PHYS 2074 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 2574 Calculus III (ACTS Equivalency = MATH 2603)	4	
PHYS 2094 University Physics III	4	

Select one of the following science four-hour lecture/lab combinations:	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) or BIOL 1584 Biology for Majors (ACTS Equivalency = BIOL 1014 Lecture)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 2584 Elementary Differential Equations		4
PHYS 3613 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 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
CSCE 2004 Programming Foundations I		
CSCE 2014 Programming Foundations II		
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)		
GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
GEOS 1133 Earth Science (ACTS Equivalency = GEOL 1124 Lecture) & GEOS 1131L 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 3083 Linear Algebra	3	
PHYS 3113 Analytical Mechanics	3	
A junior-level laboratory course chosen from PHYS 361VL, PHYS 3544, or PHYS 3213	1-4	
Social Sciences State Minimum Core (Satisfies General Education Outcome 3.3)[5]	3	
General Electives	2-5	
PHYS 3453 Electromagnetic Theory I		3
PHYS 4333 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 4073 Introduction to Quantum Mechanics	3	
Any PHYS or ASTR course numbered 3000 or higher	3	
General Electives	9	
PHYS 4991 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 2554.

[2] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[3] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[4] The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[5] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

Requirements for a B.A. Degree with a Major in Physics:

This track is for students desiring a broader program in the arts, sciences, and social sciences while 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 below. This program requires a total of 120 semester hours. The student must present 24 semester hours in physics or astronomy, including:

PHYS 2013 & PHYS 2011L	College Physics I (ACTS Equivalency = PHYS 2014 Lecture) and College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab)	4
PHYS 2033 & PHYS 2031L	College Physics II (ACTS Equivalency = PHYS 2024 Lecture) and College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab)	4
PHYS 3603 & PHYS 360VL	Introduction to Modern Physics and Introduction to Modern Physics Laboratory	4-6
PHYS 4991	Physics Senior Seminar	1
Eleven semester hours chosen from any physics or astronomy courses at the 3000 level or above.		11
The student must also present:		
MATH 1284C	Precalculus Mathematics (ACTS Equivalency = MATH 1305)	4
or MATH 1203	College Algebra (ACTS Equivalency = MATH 1103)	
or MATH 1213	Plane Trigonometry (ACTS Equivalency = MATH 1203)	
MATH 2554	Calculus I (ACTS Equivalency = MATH 2405)	4
or MATH 2043	Survey of Calculus (ACTS Equivalency = MATH 2203)	
and two additional courses at the 2000 level or above in mathematics or statistics		6-8
An additional 9 semester hours at the 3000-level or above must be taken from a single special emphasis area chosen with the adviser's approval. The special emphasis area may be chosen in any single degree-granting department at the University of Arkansas. For B.A. students seeking teacher licensure, the special emphasis area may involve courses from more than one degree-granting department at the University of Arkansas with the approval of their adviser.		9
Total Hours		**47-51**

Writing Requirement: Students majoring in physics may satisfy the Fulbright College writing requirement by means of a senior thesis (PHYS 498V), an honors thesis submitted in fulfillment of the requirements of the honors program (), or by means of a paper submitted as part of PHYS 4991 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 4991, which must be taken in the year prior to graduation.

Physics B.A. 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 the 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.

The Physics B.A. program includes requirements for a special emphasis area. In this case, journalism was used as an example. Journalism courses indicated below are recommended by the Department of Journalism as the foundation needed for science reporting. It is recommended that the free electives be chosen in a second science, or in journalism.

First Year		**Units**
	Fall	**Spring**
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013)	3	
Select one of the following:	3	
JOUR 1023 Media and Society (required for journalism sequence)[3]		
General Elective		
MATH 1203 College Algebra (ACTS Equivalency = MATH 1103) or MATH 1284C Precalculus Mathematics (ACTS Equivalency = MATH 1305)	3-4	
University/State Core Fine Arts or Humanities or US History requirement	3	
General Elective	3	

ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023)		3
Select one of the following:		3
JOUR 1033 Media Writing (required for journalism sequence)[3]		
General Elective		
Select one of the following:		3-4
MATH 1213 Plane Trigonometry (ACTS Equivalency = MATH 1203) (as required)		
MATH 2043 Survey of Calculus (ACTS Equivalency = MATH 2203)[1]		
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405)[1]		
University/State Core Humanities or US History or Fine Arts requirement		3
University/State Core Social Science requirement		3
Year Total:	15	15

Second Year		**Units**
	Fall	**Spring**
PHYS 2013 College Physics I (ACTS Equivalency = PHYS 2014 Lecture) & PHYS 2011L College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab)[1]	4	
University/State Core U.S. History or Fine Arts or Humanities requirement	3	
University/State Core Social Science requirement	3	
Select one of the following:	3-4	
MATH 2043 Survey of Calculus (ACTS Equivalency = MATH 2203) (as required)[1]		
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405)[1]		
MATH/STAT Elective[1]		
Select one of the following:	3	
JOUR 2013 News Reporting I (pre-req. JOUR 1023 and 1033)[1,3]		
General Elective		
PHYS 2033 College Physics II (ACTS Equivalency = PHYS 2024 Lecture) & PHYS 2031L College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab)[1]		4
Select one of the following:		3
JOUR 3023 News Reporting II[1,2,3]		
Other Special Emphasis Area[4]		
MATH or STAT elective[1]		3
General Electives		6
Year Total:	16	16

Third Year		**Units**
	Fall	**Spring**
PHYS 3603 Introduction to Modern Physics[1,2]	3	
MATH/STAT elective (as required) or General Elective[1]	3	
Select one of the following:	3	
JOUR 3633 Media Law[1,2,3]		
Other Special Emphasis Area[4]		
General Electives	6	
PHYS 360VL Introduction to Modern Physics Laboratory		1-3
PHYS/ASTR Group A[1,2]		3
Select one of the following:		3
JOUR 3013 Editing[1,2,3]		
Other Special Emphasis Area[4]		
3000+ Advanced Level Elective[1]		3
General Electives		6
Year Total:	15	16

Fourth Year		**Units**
	Fall	**Spring**
PHYS/ASTR Group A[1,2]	2-4	
PHYS/ASTR Group A[1,2]	3-4	
Fulbright College 3000+ Elective (as needed)[1,2]	3	
Advanced level elective[1]	6	
PHYS 4203 (or other PHYS/ASTR Group A)[1,2]		3
PHYS 4991 Physics Senior Seminar[1,2]		1
3000+ Advanced level elective (as needed) or General Elective[1]		3
General Electives (as needed to total 120 degree credits)		6
Year Total:	14	13

Total Units in Sequence:	**120**

1	Meets 40-hour advanced credit hour requirement. See College Academic Regulations.
2	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.
3	Required for journalism emphasis.
4	Additional 9 semester hours at 3000 level or above from a single emphasis area chosen with adviser approval. This requirement is automatically fulfilled by the bold-faced upper-level journalism courses.
Group A	Eleven semester hours chosen from: Any PHYS or ASTR classes numbered 3000 or above.

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

Select one of the following:		8
PHYS 2013 & PHYS 2011L & PHYS 2033 & PHYS 2031L	College Physics I (ACTS Equivalency = PHYS 2014 Lecture) and College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab) and College Physics II (ACTS Equivalency = PHYS 2024 Lecture) and College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab)	
PHYS 2054 & PHYS 2074	University Physics I (ACTS Equivalency = PHYS 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 399VH and
   Three hours of physics honors colloquium PHYS 3923H,
4. Complete and orally defend an honors thesis based upon the project carried out in PHYS 399VH,
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 or Secondary Teacher Licensure in mathematics, biology, chemistry, physics, or computer science at the undergraduate level should consult with a STEM Education faculty adviser, teach@uark.edu. Another option to obtain secondary teacher licensure is to complete the one-year Master of Arts in Teaching (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences/mathematicalsciencesmasc/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), Associate Professor, 2015, 2021.
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), Assistant Professor, 2017.
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), Associate Professor, 2003, 2014.
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 Assistant Professor, 2017.
Nakamura, Hiroyuki, Ph.D., M.S., B.S. (University of Tokyo), Assistant Professor, 2019.
Oliver, William, Ph.D., M.S. (University of Colorado-Boulder), B.S. (University of Arizona), Associate Professor, 1992, 1998.
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.
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), Assistant Professor, 2016.
Xiao, Min, Ph.D. (University of Texas at Austin), B.S. (Nanjing University), Distinguished Professor, 1990, 2004.

Astronomy Courses

ASTR 2001L. 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 2003. (Typically offered: Fall, Spring and Summer)

ASTR 2001M. 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 2003 or ASTR 2003H. (Typically offered: Fall)
This course is equivalent to ASTR 2001L.

ASTR 2003. 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 2001L or ASTR 2001M. (Typically offered: Fall, Spring and Summer)

ASTR 2003H. 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 2001M. (Typically offered: Fall)
This course is equivalent to ASTR 2003.

ASTR 4033. 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 3613 or CHEM 3504. (Typically offered: Fall Odd Years)

ASTR 4043. 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 4033. (Typically offered: Spring Even Years)

ASTR 4073. 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 3613 or CHEM 3504. (Typically offered: Spring Odd Years)

ASTR 4083. 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 3613. (Typically offered: Fall Even Years)

Physics Courses

PHYS 1021L. Physics and Human Affairs Laboratory. 1 Hour.
Laboratory 2 hours per week. Pre- or Corequisite: PHYS 1023. (Typically offered: Fall, Spring and Summer)

PHYS 1021M. Honors Physics and Human Affairs Laboratory. 1 Hour.
Laboratory 2 hours per week. Pre- or Corequisite: PHYS 1023H. (Typically offered: Fall, Spring and Summer)
This course is equivalent to PHYS 1021L.

PHYS 1023. 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 1021L, can be used to satisfy a 4-year physical science requirement for a B.A. degree. Students who have received credit in PHYS 2013 and PHYS 2033, or PHYS 2054 and PHYS 2074 cannot also receive degree credit in this course. Corequisite: PHYS 1021L. (Typically offered: Fall, Spring and Summer)

PHYS 1023H. 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 1021L, can be used to satisfy a 4-year physical science requirement for a B.A. degree. Students who have received credit in PHYS 2013 and PHYS 2033, or PHYS 2054 and PHYS 2074 cannot also receive degree credit in this course. Corequisite: PHYS 1021M. (Typically offered: Fall, Spring and Summer)
This course is equivalent to PHYS 1023.

PHYS 1034. 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 1044. Physics for Architects I. 4 Hours.
Algebra-based physics covering forces and motion with emphasis on architectural structural support systems such as beams, cables, columns, and trusses. Topics include physical concepts such as linear motion, position, velocity, acceleration, forces, free-body diagrams, rotational motion, torque, center of gravity, impulse, oscillations, 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 1054. Physics for Architects II. 4 Hours.
Algebra-based physics covering thermal materials, fluid flow, acoustics, electricity, and optics with emphasis on architectural design. Topics include physical concepts such as potential and thermal energy, heat pumps, water pressure, fluid dynamics, sound waves, loudness, electrical systems, direct and alternating current, series and parallel circuits, optical instruments, reflection, and refraction. Corequisite: Lab component. Prerequisite: Major in architecture or interior design or agricultural education communication & technology. (Typically offered: Spring)

PHYS 2011L. College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab). 1 Hour.
Laboratory 2 hours per week. Corequisite: PHYS 2013. (Typically offered: Fall and Summer)

PHYS 2013. 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 2011L. Prerequisite: (MATH 1203 and MATH 1213) or (MATH 1284C or MATH 2043 or MATH 2554) 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 2031L. College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab). 1 Hour.
Laboratory 2 hours per week. Corequisite: PHYS 2033. (Typically offered: Summer)

PHYS 2033. College Physics II (ACTS Equivalency = PHYS 2024 Lecture). 3 Hours.
Continuation of PHYS 2013. 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 2031L. Prerequisite: PHYS 2013 or PHYS 2054 or PHYS 2054H. (Typically offered: Spring and Summer)

PHYS 2054. 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 2554. (Typically offered: Fall, Spring and Summer)

PHYS 2054H. 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 2554. (Typically offered: Fall, Spring and Summer)
This course is equivalent to PHYS 2054.

PHYS 2074. University Physics II (ACTS Equivalency = PHYS 2044 Lecture). 4 Hours.
Continuation of PHYS 2054. 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 2054 and MATH 2564. (Typically offered: Fall, Spring and Summer)

PHYS 2074H. Honors University Physics II. 4 Hours.
Continuation of PHYS 2054H. 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 2054 or PHYS 2054H) and MATH 2564. (Typically offered: Spring)
This course is equivalent to PHYS 2074.

PHYS 2094. University Physics III. 4 Hours.
A continuation of PHYS 2054 and PHYS 2074. 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 2574. Corequisite: Lab component. Prerequisite: PHYS 2074. (Typically offered: Fall)

PHYS 306V. 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 3113. 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 2584. (Typically offered: Fall)

PHYS 3213. 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 2094 or instructor consent. (Typically offered: Spring Odd Years)

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

PHYS 3453. 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 2584. Prerequisite: MATH 2574 and PHYS 2074. (Typically offered: Spring)

PHYS 3463. 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 3453. (Typically offered: Fall)

PHYS 3544. Optics. 4 Hours.
Elements of geometrical, physical, and quantum optics. Lecture 3 hours, laboratory 2 hours. Corequisite: Lab component. Prerequisite: PHYS 2074 and MATH 2564. (Typically offered: Fall)

PHYS 3603. 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 2033 and MATH 2043 or MATH 2554. (Typically offered: Fall)

PHYS 360VL. 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 3603. (Typically offered: Fall)

PHYS 3613. Modern Physics. 3 Hours.
Introduction to special relativity, statistical physics, quantum physics, and a survey of molecules, solids, and statistical physics. Prerequisite: PHYS 2074. (Typically offered: Fall, Spring and Summer)

PHYS 361VL. Modern Physics Laboratory. 1-3 Hour.
Advanced experiments, projects, and techniques in atomic, nuclear, and solid state physics. Pre- or corequisite: PHYS 3613. (Typically offered: Fall) May be repeated for up to 3 hours of degree credit.

PHYS 3923H. 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 399VH. 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 4073. 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 3613, MATH 2574, and MATH 2584. (Typically offered: Fall)

PHYS 4083. 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 4073, MATH 2574, and MATH 2584. (Typically offered: Spring)

PHYS 4113. 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 3613. (Typically offered: Irregular)

PHYS 4213. 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 3613. (Typically offered: Irregular)

PHYS 4333. Thermal Physics. 3 Hours.
Equilibrium thermodynamics, statistical physics, and kinetic energy. Prerequisite: PHYS 3613. (Typically offered: Spring)

PHYS 4613. 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 3613 or consent. (Typically offered: Spring)

PHYS 4653. 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 3613. (Typically offered: Fall Odd Years)

PHYS 4713. 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 4073. (Typically offered: Spring Even Years)

PHYS 4734. 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 3544. (Typically offered: Spring)

PHYS 4773. 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 3544. (Typically offered: Spring)

PHYS 498V. Senior Thesis. 1-6 Hour.
Senior Thesis. (Typically offered: Fall, Spring and Summer)

PHYS 4991. 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)