

# Physics BS, Astrophysics Emphasis

The study of astrophysics aims to understand the universe and everything within it in terms of the fundamental nature of forces and particles. The Department of Physics and Astronomy at UMSL is devoted to providing undergraduates with a broad-based education in astrophysics with the experimental, observational, and theoretical skills essential to practicing astronomers and astrophysicists. Undergraduate education in astrophysics prepares students for both graduate study and professional careers in astronomy, atmospheric science, image processing, cosmology, and instrumentation.

## General Education Requirements

Majors must complete the university and college general education requirements. Any of the following courses may be used to satisfy the physical science requirement:

ASTRON 1001	Cosmic Evolution Introductory Astronomy (MOTR ASTR 100)	3
ASTRON 1011	Planets and Life in the Universe	3
ASTRON 1012	The Violent Universe and the New Astronomy	3
ASTRON 1050	Introduction to Astronomy I (MOTR ASTR 100)	3
ASTRON 1051	Introduction to Astronomy II	3
ATM SCI 1001	Elementary Meteorology	3
GEOL 1001	General Geology	3
GEOL 1002	Historical Geology	3
PHYSICS 1001	How Things Work (MOTR PHYS 100)	3
PHYSICS 1011	Basic Physics I	3
PHYSICS 1011L	Basic Physics I Laboratory	1
PHYSICS 1012	Basic Physics II	3
PHYSICS 1012L	Basic Physics II Laboratory	1
PHYSICS 2111	Physics: Mechanics and Heat	4
PHYSICS 2112	Physics: Electricity, Magnetism, and Optics	4

## Declaring the Physics Major

Students seeking to major in physics are first designated as 'pre-physics majors' until they have completed both PHYSICS 2111 and PHYSICS 2112 or equivalent courses. Upon successful completion of PHYSICS 2111 and PHYSICS 2112 with grades of C- or better, students will be allowed to declare physics as their major. Each of these courses must be completed successfully within two attempts.

## Degree Requirements

All physics majors in all programs must complete the physics core curriculum with the exception that majors pursuing the Physics Education option are not required to take PHYSICS 1099 and CMP SCI 1250. In addition to the core courses, each individual program has its own specific requirements. Required Physics, Mathematics, Chemistry, Biology, and Computer Science courses for a major or minor in physics may not be taken on a satisfactory/unsatisfactory grading basis.

### Core Curriculum

The following physics courses are required:		23
PHYSICS 1099	Windows on Physics	
PHYSICS 2111	Physics: Mechanics and Heat	
PHYSICS 2111L	Mechanics and Heat Laboratory	
PHYSICS 2112	Physics: Electricity, Magnetism, and Optics	
PHYSICS 2112L	Electricity, Magnetism, and Optics Laboratory	
PHYSICS 3200	Mathematical Methods of Theoretical Physics	
PHYSICS 3221	Mechanics	
PHYSICS 3223	Electricity and Magnetism	
PHYSICS 3231	Introduction to Modern Physics I	
Also required are:		26
MATH 1800	Analytic Geometry and Calculus I	
MATH 1900	Analytic Geometry and Calculus II	
MATH 2000	Analytic Geometry and Calculus III	
MATH 2020	Introduction to Differential Equations	
CHEM 1111	Introductory Chemistry I (MOTR CHEM 150L)	
CMP SCI 1250	Introduction to Computing	

**Total Hours** **49**

Note: Students are urged to begin the calculus sequence [MATH 1800, Analytic Geometry and Calculus I] as soon as possible to avoid delays in graduation.

Students with experience in digital computer programming may be excused from CMP SCI 1250.

## Astrophysics Option

Students who have interests in the aerospace sciences or anticipate graduate studies in astrophysics may elect this option. At least 48 hours must be taken. In addition to the core curriculum, the following physics courses are required:

<b>Physics</b>		
PHYSICS 4323	Modern Optics	3
PHYSICS 4331	Intro to Quantum Mechanics	3
PHYSICS 4341	Thermal and Statistical Physics	3
PHYSICS 4350	Computational Physics	3

<b>Astronomy</b>		
ASTRON 1050	Introduction to Astronomy I (MOTR ASTR 100)	3
ASTRON 1051	Introduction to Astronomy II	3
ASTRON 4301	Astrophysics	3
ASTRON 4322	Observational Astronomy	4
Select one physics elective at or above the 4000 level. <sup>1</sup>		3

<b>Mathematics</b>		
MATH 2450		3

**Total Hours** **31**

<sup>1</sup> With consent of the astronomy adviser, there may be substitution of ASTRON 1001, ASTRON 1011 or ASTRON 1012 for ASTRON 1050 or ASTRON 1051.

## Program Purpose

The purpose of the B.S. in Physics (Astrophysics Option) program at the University of Missouri at St. Louis is to prepare students for a professional career in astrophysics or a related field, or for graduate studies in astrophysics.

## Learning Outcomes

- Students will be able to demonstrate an understanding of basic physics concepts including classical mechanics, electricity and magnetism, thermal and statistical physics, modern optics, and quantum mechanics
- Students will be able to demonstrate an understanding of basic principles and concepts of modern astrophysics and observational astronomy
- Students will be able to perform astronomical observations, reduce and critically interpret their data
- Students will be skilled in problem-solving, critical thinking and analytical reasoning as applied to scientific problems
- Students will be proficient in both written and oral communication of the results of scientific work
- Students will have the skills necessary for conducting original scientific research as part of a problem-solving team
- Students will have the skills necessary to identify possible errors in scientific data, and to assess the significance of observed results

## Sample Four Year Plan

### First Year

Fall	Hours	Spring	Hours
INTDSC 1003 <sup>1</sup>		1 ASTRON 1051	3
PHYSICS 1099		1 MATH 1800	5
CHEM 1111		5 CORE - US History and Government	3
MATH 1030		3 EXPLORE - Social Sciences	3
MATH 1035		2	
ENGL 1100		3	
	15		14

### Second Year

Fall	Hours	Spring	Hours
PHYSICS 2111		4 PHYSICS 2112	4
PHYSICS 2111L		1 PHYSICS 2112L	1
MATH 1900		5 MATH 2000	5
ASTRON 1050		3 MATH 2450	3
CMP SCI 1250		3 CORE - Communication Proficiency	3
	16		16

### Third Year

Fall	Hours	Spring	Hours
PHYSICS 3200		3 PHYSICS 3221	3
PHYSICS 3231		3 PHYSICS 3223	3
MATH 2020		3 PHYSICS 4341	3
EXPLORE - Humanities and Fine Arts		3 PHYSIC/ASTRON 4XXX Physics or Astronomy Course	3
Cultural Diversity Requirement		3 EXPLORE - Humanities & Fine Arts	3
	15		15

### Fourth Year

Fall	Hours	Spring	Hours
PHYSICS 4331		3 ASTRON 4301 or 4322	3
PHYSICS 4323		3 PHYSICS 4350	3
PHYSICS 4XXX Physics or Astronomy Course		3 EXPLORE - Humanities and Fine Arts	3
ENGL 3160		3 EXPLORE - Social Sciences	3
EXPLORE - Social Sciences		3 Elective or minor	2
	15		14

**Total Hours: 120**

<sup>1</sup> INTDSC 1003 is required only for first-time freshmen and transfer students with less than 24 college credits.

*Please Note: This plan is an example of what a four year plan could look like for a typical student. Placement exam scores in math as well as the completion of coursework may change the plan. It should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor each semester. All requirements are subject to change.*