

Undergraduate Handbook

Dept. of Physics & Astronomy

Univ. of Missouri – St. Louis

2019-2020







Welcome to the Department of Physics and Astronomy at the University of Missouri-St. Louis. This brief student advising handbook is designed to answer the most commonly asked questions concerning study in the program and related matters.

You are encouraged to read this comprehensive guide carefully. Also be sure to check the Department bulletin boards regularly for important announcements and consult our home page (<u>http://www.umsl.edu/~physics/</u>).

Any further inquiries can be directed to:

The Department of Physics and Astronomy 516 Benton Hall University of Missouri-St. Louis 314-516-5931

I.	THE FACULTY	3
II.	ADMISSIONS AND REGULATIONS	6
III.	THE PHYSICS DEGREE PROGRAMS	7
IV.	SUGGESTED COURSE PLANS	12
V.	TENTATIVE THREE-YEAR TEACHING PLAN	14
VI.	BS IN PHYSICS WITH EDUCATION EMPHASIS	15
VII.	COURSE DESCRIPTIONS	16
VIII.	SCHOLARSHIPS, AWARDS, AND FINANCIAL SUPPORT	24
IX.	THE PHYSICS CLUB	26
X.	TRANSFER CREDITS	27
XI.	CAREER OUTLOOK	28

I. THE FACULTY

Sonya Bahar, Professor

Ph.D, University of Rochester

Biophysics, Nonlinear Dynamics, Neuroscience

Dr. Bahar applies the physics of nonlinear dynamics and complex systems to the study of collective biological phenomena. Her most recent work involves the development of models for the process of speciation in biological evolution. She is investigating how (1) parameters such as mutation rate affect the dynamics of speciation, (2) how evolutionary processes can be described with the statistical physics of nonequilibrium phase transitions, and (3) how physics-based approaches can be used to gain insights into the problem of multi-level selection. Other research projects in include computational and experimental studies of neural synchronization in pathological processes such as epilepsy. Her group has used voltage-sensitive dyes in order to investigate neural synchronization during focal seizures in the rat neocortex. Other projects involve the use of nonlinear techniques for the investigation of human neural processes, such as synchronization between eye and target movement in mild traumatic brain injured (mTBI) patients.

Bernard J. Feldman, Professor

Ph.D., Harvard University

Physics Education

Dr. Feldman's research interests are in physics education. Recent physics education papers include "The Hybrid Automobile and the Atkinson Cycle," [The Physics Teacher, 46, 420 (2008)], "The Physics of Bird Flight: An Experiment," [The Physics Teacher 46, 155 (2008)], "The Nimitz Freeway collapse," [The Physics Teacher 42, 400 (2004)] and "Hydrogen fuel cell automobiles," [The Physics Teacher,43, 492 (2005)]. For the last two years, he has been interested in the relationship between radiofrequency radiation from cell phones and cancer in rats, mice and humans. He have written two papers on the subject, "Explanation for Cancer in Rats, Mice and Humans due to Cell Phone Radiofrequency Radiation" [https://arxiv.org/abs/1608.01936] and "Possible Explanation of Cancer in Rats due to Cell Phone Radiofrequency Radiation" [US-China Educational Review B 6, 609-613(2016)], providing evidence that the same mechanism of Faraday induction in closed neural circuits around the brain and the heart is at work in rats, mice and humans.

Michael Fix, Teaching Professor

Masters Degree, Washington University

Paleontology and Stratigraphy

Professor Fix does his research on the late Cretaceous age (about 75 million years ago) Chronister Dinosaur Site in Southeastern Missouri, the only known dinosaur site in the entire state. This site has yielded numerous bones of a hadrosaur (duck-bill dinosaur), and fossils of two other dinosaurs, a relative of *T- rex* and a relative of *Velociraptor*, as well as fossils of turtles, fish and amphibians. Currently, he is working in collaboration with a group from the Field Museum in Chicago under the direction of Dr. Peter Makovicky. This new dig has revealed more skull material from the hadrosaur as well as some articulated limb bones. Hopefully, this new dig will help to improve our knowledge of the evolutionary relationship of this species to other hadrosaurs. We hope to find more remains of the other two known dinosaurs previously found at the site, and perhaps remains of dinosaurs not previously known from the site. Also, we seek to increase our knowledge of the other species of animals and plants that lived alongside the dinosaurs, to learn more about the paleoenvironment and how the deposit that contains the fossils was formed. Dinosaur sites are relatively rare in the eastern U.S., and fewer still are sites that yield as many fossils, and so this site is very important in documenting the biogeographic distribution of dinosaur species of the late Cretaceous period as well as evolutionary patterns.

Ricardo A. Flores, Professor

Ph.D., University of California-Santa Cruz

Particle Physics/Astrophysical Cosmology

Dr. Flores' work in astrophysics concentrates on understanding the properties and formation of galaxies and clusters of galaxies, and how they test cosmological theories. His work in particle physics is mostly on searches for supersymmetric dark matter and the structure of nucleons; he is also interested in neutrino oscillations.

Philip B Fraundorf, Associate Professor

Ph.D., Washington University

Materials Physics & Astronomy, Nanoscale Characterization, Modernizing Content

Research highlights and developing stories, listed at http://www.umsl.edu/~fraundor/hilights.html, involve nanoscale structures in electronic and extraterrestrial materials, atomic resolution electron and scanning probe microscopy, computer simulations, and development of emergent-content course material involving nanoscale detective challenges as well as energy and information in everyday life. The first two items involve a triple/bi-story building designed for regional outreach, with Missouri's only atomic resolution transmission electron microscope along with research grade atomic force and scanning electron microscopes. The increased relevance of nanoscale detective work in fields of electronic and extraterrestrial materials, medicine, catalysis, crime scene investigation and metals has brought in cross-disciplinary collaborations, helped start a statewide nano-alliance, and put graduates into jobs with employers MEMC Electronic Materials (St. Peters MO), Seagate (Minneapolis), Martin-Marietta (New Orleans), Mitsubishi Silicon America (Portland), and most recently Motorola's Digital DNA Lab (Mesa AZ).

Erika Gibb, Professor and Chairperson

Ph.D., Rensselaer Polytechnic Institute

Observational Astrophysics/Astrobiology

Dr. Gibb is an astrochemist, studying chemistry in star formation regions and comets. One of the most exciting areas of astrobiological research is the search for organic molecules of prebiotic importance in disks and envelopes of gas and dust around low mass young stars that are thought to be similar to the young solar system. She uses infrared spectroscopy to detect molecules and infer the quantity, temperature, and location of each molecule. The observations are usually performed at major telescopes like the 10-meter Keck Observatory and the 3-meter Infrared Telescope Facility on Mauna Kea, HI or the 8-meter Gemini South Observatory in Chile. She also collaborates with a research group at NASA Goddard Space Flight center to measure abundances of those same molecules in comets, which are thought to have been a source of much of the early Earth's reserve of organics and water. In this way, she hopes to track the organic chemistry through the star and planet formation process and to be able to infer the role that comets may have played on delivery of organics and water necessary for life on Earth.

Bob L. Henson, Professor

Ph.D., Washington University

Mathematical and Statistical Physics

Dr. Henson's primary research efforts now are mostly theoretical, but at a reduced level of activity. Currently, his primary interests are in atmospheric physics and the fundamental foundations of statistical mechanics. However, Dr. Henson's main scholarly activity now is writing a text on the topic of atmospheric physics at the senior-graduate level. He is approaching this by writing up and expanding his class notes for Physics 4354 (Atmospheric Physics), which he has taught several times over the past thirty years.

Eric Majzoub, Professor

Ph.D., Washington University

Computational and Theoretical Physics

Beginning in 2018, the research focus of the group is moving toward a theoretical understanding of emergent phenomena. In particular we are interested in the emergence of classical geometry from interacting quantum systems. The overarching goal is to understand the various theoretical approaches to the emergence of spacetime-like mathematical structures. Current research interests: emergent geometry from large N matrix models, AdS/CFT, entanglement entropy of interacting quantum systems.

Bruce A. Wilking, Professor and Associate Chairperson

Ph.D., University of Arizona

Observational Astrophysics

The earliest stages in the formation of stars are hidden from view by microscopic dust. Since infrared and radio wavelengths of light are relatively unaffected by this dust, Dr. Wilking makes astronomical observations at these wavelengths to study the formation of low mass stars. Using infrared imaging and spectroscopy, Dr. Wilking studies the ages and masses of young stars in nearby clouds to reconstruct the star-forming history of the region. Using radio interferometry, observations of water masers are used to trace the dynamics and distribution of dense gas surrounding the youngest stars. Undergraduate research stipends in astrophysics are available for the summer and academic year through the NASA/Missouri Space Grant Consortium.



II. ADMISSIONS AND REGULATIONS

Admission

Students must meet the general requirements for admission to the University, which are stated in the BULLETIN of the University of Missouri-St. Louis.

Students transferring from other colleges and universities must submit the following information to the UM-St. Louis Director of Admissions:

- (i) Undergraduate Application for Admission;
- (ii) High School Transcript;
- (iii) Official Transcripts from all colleges/universities attended.

Please check with the Department for detailed information concerning transferring credit hours from local community colleges.

Registration and Cancellation

Each semester, you will receive information from the Registrar about how to register for classes through MyView. Every Physics Major will have an "advising hold" on their registration each semester. Once you have talked with Dr. Sonya Bahar, Undergraduate Advisor, about the courses you plan to take, she will have the advising hold lifted and then you can register. Dr. Bahar's office is 516C Benton Hall, telephone number is 314-516-7150 and email address is <u>bahars@umsl.edu</u>. Ideally, you should contact her at the earliest convenient date before each semester to help the Department track projected course enrollment and to make sure you aren't missing any of the courses you need as prerequisites.

Students who have enrolled and paid their fees but do not wish to attend the University may cancel their registration at the Office of the Registrar according to university policy.

Auditor

A student may enroll as an auditor in any course with the prior consent of the instructor and dean of the school or college in which the auditor is registered. Auditors are charged full fees and receive no academic credit.

Grading System

The grading system available to all faculty in all schools, colleges, and other parallel units is

A = 4.0	A - = 3.7	B + = 3.3	B = 3.0
B-=2.7	C + = 2.3	C = 2.0	C - = 1.7
D + = 1.3	D = 1.0	D - = 0.7	F = 0.0

III. THE PHYSICS DEGREE PROGRAMS

The Program

The study of physics is an attempt to understand the fundamental nature of the forces and particles and the resultant states of matter that make up the physical world. The Department of Physics and Astronomy at UM-St. Louis is devoted to providing undergraduates with a broad-based education in the fundamental concepts of physics and with the experimental and theoretical skills essential to practicing scientists. Outside the classroom, research opportunities for undergraduates are available in many fields. Undergraduate education in physics prepares students for both graduate study and professional careers.

The Department offers course work leading to a B.A. in Physics, a B.S. in Physics, and in cooperation with the School of Education, a B.A. in Physics with teacher certification and a B.S. in Education with an emphasis in Physics.

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:

Astronomy: 1001, 1001A, 1011, 1012, 1121, 1050, 1051. Atmospheric Science: 1001, 1001A. Geology: 1001, 1002, 1001A, 1002A. Physics: 1001, 1011, 1011A, 1012, 1012A, 2111, 2112.

Degree Requirements for Major in Physics

All physics majors, who are transfer students, must complete Physics 1099, Windows on Physics. First time freshmen must take INTDSC 1003. All physics majors in all programs must complete the physics core curriculum. In addition to the core courses, each individual program has its own specific requirements. Required Physics, Mathematics, Chemistry, Biology, Optometry 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:

2111, Physics: Mechanics and Heat

2112, Physics: Electricity, Magnetism, and Optics

3200, Mathematical Methods of Theoretical Physics

3221, Mechanics

3223, Electricity and Magnetism

3231, Introduction to Modern Physics I

Also required are:

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 or equivalent Computer Science 1250, Introduction to Computer Science

Note: Students are urged to begin the calculus sequence (Math 1800, Math 1900 and Math 2000) as soon as possible to avoid delays in graduation.

Students with experience in digital computer programming may be excused from Computer Science 1250.

***** Bachelor of Arts in Physics** the B.A. program is tailored to students wishing to preserve the option for specialization in graduate school without sacrificing the advantages of a liberal arts education. The Department of Physics and Astronomy will accept the three-course sequence in American Sign Language as satisfying the foreign language requirement for this degree. In addition to the core curriculum, including the foreign language requirement, at least three physics electives at the 3000 or 4000 level must be completed. It is recommended that at least one of these three electives includes Astronomy 4322, Physics 4311 or Physics 4347 for the required capstone course. At least 31 hours of physics courses, but no more than 45 hours, are required.

******* Bachelor of Science in Physics The B.S. degree provides students with four options: general physics, astrophysics, engineering physics, and biophysics.

1. General Physics Option

This option may be elected by students desiring a greater concentration in physics and mathematics and is recommended for students wishing to enter graduate study in physics. At least 50 hours are required. In addition to the core curriculum, the following physics courses are required:

Physics

4310, Modern Electronics
4311, Advanced Physics Laboratory I
4323, Modern Optics
4331, Introduction to Quantum Mechanics
4341, Thermal and Statistical Physics
4350, Computational Physics (or a 4000 level mathematics course)
and three electives at or above the 4000 level in physics or astronomy.

Astronomy 1050, Introduction to Astronomy I or 1051, Introduction to Astronomy II

Also required are: Mathematics MATH 2450, Elementary Linear Algebra and one elective in mathematics at or above the 3000 level, or in

and one elective in mathematics at or above the 3000 level, or in computer science at or above the 2000 level.

Chemistry

1121, Introductory Chemistry II, or equivalent

2. Astrophysics Option

This option may be elected by students who have interests in the aerospace science or anticipate graduate studies in astrophysics. At least 48 hours must be taken. In addition to the core curriculum, the following physics courses are required:

Physics

4323, Modern Optics
4331, Introduction to Quantum Mechanics
4341, Thermal and Statistical Physics
4350, Computational Physics

Astronomy

1050, Introduction to Astronomy I1051, Introduction to Astronomy II4301, Astrophysics4322, Observational Astronomy

And one physics elective at or above the 4000 level. With consent of the astronomy adviser, there may be substitution of Astronomy 1001, 1011, or 1012 for 1050 or 1051.

Also required: Math 2450, Elementary Linear Algebra

3. Engineering Physics Option

Students interested in careers in the research and development field of industry should consider this option. This program exposes the student to a basic engineering curriculum, as well as to areas of physics with industrial applications, such as electronics, modern optics, and linear analysis. At least 49 hours, but no more than 51, are required. In addition to the core curriculum, the following courses are required:

Joint Engineering 2310, Statics 2320, Dynamics Joint Electrical Engineering 2300, Introduction to Electrical Networks

Physics
4310, Modern Electronics
4311, Advanced Physics Laboratory I
4323, Modern Optics
4331, Introduction to Quantum Mechanics
4341, Thermal and Statistical Physics

Math

1320, Applied Statistics I and 2450, Elementary Linear Algebra

Also required is one elective in math at or above the 3000 level, or in computer science at or above the 2000 level.

4. **Biophysics Option**

This option is designed for students who are interested in careers in various medical fields or biophysics. This option provides a strong preparation in physics, mathematics, chemistry, and biology for students who intend to apply for admission to medical school, to an interdisciplinary graduate program such as biophysics or bioengineering, or to pursue an interdisciplinary scientific career. At least 41 hours of physics and biology combined, but no more than 51, are required. In addition to the physics core curriculum, the following physics and biology courses are required:

Physics4310, Modern Electronics4347, Introduction to Biophysicsand two additional physics electives at the 4000 level.

Biology

1811, Introductory Biology I, From Molecules to Organisms1821, Introductory Biology II, Organisms and the Environment

Also required are:

Chemistry

1121, Introductory Chemistry II2612, Organic Chemistry I2622, Organic Chemistry II2633, Organic Chemistry Laboratory

Physics Education Programs

Bachelor of Science in Education with Emphasis in Physics

This program is designed for students wishing to teach physics in secondary schools and give a firm foundation in the history, philosophy and principles of physics. Students are typically expected to fulfill he School of Education's general education requirements. For details, see Section VI and contact the College of Education advising office at 314-516-5937.

Master's Level Teaching Certification for Physics Majors

Physics majors who complete a B.A. or B.S. degree in Physics may obtain teaching certification through the Graduate School and College of Education's Teach in 12 program. Contact the advising office (OASIS) 314-516-5937 in the College of Education for program requirements, or visit the Teach in 12 website: <u>http://coe.umsl.edu/advising/t12/</u>.

Minor in Physics

Students may complete a minor in physics with the flexibility of emphasis on classical physics, modern physics, or a combination of the two areas. The following physics courses are required:

1099, Windows on Physics or INTDSC 1003, Freshman Success Seminar
2111, Mechanics and Heat
2112, Electricity, Magnetism, and Optics
3200, Mathematical Methods of Theoretical Physics
and two additional emphasis courses chosen from the following physics courses:
3221, Mechanics
3223, Electricity and Magnetism
3231, Introduction to Modern Physics
4310, Modern Electronics

A GPA of at least 2.0 is required in courses presented for a minor. It is required that a student completes a minimum of 6 hours of graded work in 2000 level or above courses on the UM-St. Louis campus.



IV. SUGGESTED COURSE PLANS FOR BS DEGREES

The suggested sequences of courses below have been designed with prerequisites and current offerings in mind in order that students may be able to graduate in minimum of four years. However, because the Department of Physics & Astronomy has no control over course offerings outside the department, it may not always be possible for each individual student to graduate in four years. Also, future offerings within the department will be dependent upon having sufficient faculty and monetary resources.

General Physics Option

Beginning:			
Fall 1	<u>Spring 1</u>	<u>Fall 2</u>	Spring 2
Phys 1099	Math 1800	Phys 2111	Phys 2112
Math 1030	Chem 1121	Math 1900	Math 2000
Math 1035	Option 1:	CSci 1250	Math 2450
Chem 1111	Ast 1051	Option 2:	CSci 2xxx or
		Ast 1050	Math 3xxx
Advanced:			
<u>Fall 3</u>	Spring 3	Fall 4	Spring 4
Phys 3200	Phys 3221	Phys 4331	Phys 4310 or
Phys 3231	Phys 3223	Phys 4323*	Phys 4311
Math 2020	Phys 4341	Phys 43xx	Phys 4350
	Phys 4310 or	Phys 43xx	Phys 43xx
	Phys 4311		

Astrophysics Option

Beginning:			
Fall 1	Spring 1	Fall 2	Spring 2
Phys 1099	Math 1800	Phys 2111	Phys 2112
Math 1030	Ast 1051	Math 1900	Math 2000
Math 1035		CSci 1250	Math 2450
Chem 1111		Ast 1050	
Advanced:			
<u>Fall 3</u>	Spring 3	Fall 4	Spring 4
Phys 3200	Phys 3221	Phys 4331	Phys 4350
Phys 3231	Phys 3223	Phys 4323*	Ast 4301 or
Math 2020	Phys 4341	Phys 43xx	Ast 4322
	Ast 4301 or		
	Ast 4322		

*PHYS 4323 is offered in the fall semesters of even-numbered years. If this does not work for your schedule, please see your advisor to discuss alternative course options.

Engineering Physics Option

Beginning: <u>Fall 1</u> Phys 1099 Math 1030 Math 1035 Chem 1111	<u>Spring 1</u> Math 1800	<u>Fall 2</u> Phys 2111 Math 1900 CSci 1250 Math 1320	<u>Spring 2</u> Phys 2112 Math 2000 Engr 2310 Math 2450
Advanced: <u>Fall 3</u> Phys 3200 Phys 3231 Math 2020 Engr 2320	<u>Spring 3</u> Phys 3221 Phys 3223 Phys 4341 Phys 4310 or Phys 4311	<u>Fall 4</u> Phys 4331 JEE 2300 Phys 4323**	<u>Spring 4</u> Phys 4310 or Phys 4311 Csci 2xxx or Math 3xxx
Biophysics Option	I		
Beginning:			
<u>Fall 1</u>	Spring 1	<u>Fall 2</u>	Spring 2
Phys 1099 Math 1020	Math 1800	Phys 2111 Math 1000	Phys 2112 Math 2000
Math 1030	Ast 1050 or 1051	Main 1900	Math 2000
Chem 1111	Biol 1811	Biol 1821	Chem 2612
Advanced:			
Fall 3	Spring 3	<u>Fall 4</u>	Spring 4
Phys 3200	Phys 3221	Phys 4331*	Phys 4347
Phys 3231	Phys 3223	Biol 4713	
Math 2020	Phys 4341*		
Biol/Chem 4712	Phys 4310***		

*Recommended but not required. Students must take two additional courses at the 4000 level; these starred courses are recommended options to fulfill this requirement.

****** PHYS 4323 is offered in the fall semesters of even-numbered years. If this does not work for your schedule, please see your advisor to discuss alternative course options.

***Phys 4310 is offered in alternate spring semesters (the spring of odd-numbered years). If it is not offered in the spring of your junior year, you can take it in the spring of your senior year.

COURSE	FS-18	SP-19	FS-19	SP-20	FS-20	SP-21
AS1001	Ι		Ι		I	
AS1001L	I		Ι		Ι	
AS1002		Ι		Ι		I
A1001	D		D		D	
A1001L	D		D		D	
A1011	Ι	D	Ι	D	Ι	D
A1012						
A1050	D		D		D	
A1051		D		D		D
G1001	D	D	D	D	D	D
G1001L	D	D	D	D	D	D
G1002	D	D	D	D	D	D
G1002L	D	D	D	D	D	D
G1053		Ι		Ι		I
P1001	D	D	D	D	D	D
P1011	D	Ε	D	Ε	D	E
P1011L	D	Ε	D	E	D	E
P1012	Ε	D	Ε	D	E	D
P1012L	Ε	D	E	D	E	D
P2111	D	Ε	D	D	D	E
P2111L	D	Ε	D	E	D	E
P2112	Ε	D	E	D	E	D
P2112L	Ε	D	E	D	E	D

INTRODUCTORY UNDERGRADUATE COURSES

CODE: AS=Atmospheric Science; A=Astronomy; P=Physics;

G=Geology; D=Day; E=Evening; I=Internet Course; FS=Fall Semester; SP=Spring Semester

-	ID (111)(0)		LICOICH	CHIL C		,
COURSE	FS-18	SP-19	FS-19	SP-20	FS-20	SP-21
A4301		D				D
A4322				D		
P3200	D		D		D	
P3221		D		E		D
P3223		D		D		D
P3231	D		D		D	
P3281	D	D	D	D	D	D
P3390	D	D	D	D	D	D
P4304				D		
P4305		D				D
P4306			D			
P4310	D		D		D	
P4311		D		D		D
P4323	I		I		I	
P4331	D		D		D	
P4341		D		D		D
P4347				D		
P4350		D		D		D
P4351			D			
P4353		E				
P4358	D				D	
P4365						E
P4370	I		I		I	
P4381	D	D	D	D	D	D

ADVANCED UNDERGRADUATE COURSES

CODE: A=Astronomy; P=Physics; D=Day; E=Evening; I=Internet Course; FS=Fall Semester; SP=Spring Semester

VI. B.S. IN EDUCATION WITH PHYSICS EMPHASIS THROUGH THE COLLEGE OF EDUCATION

The curriculum described below is revised from the curriculum used in recent years, and is expected to be approved soon by the Missouri Department of Elementary and Secondary Education. Contact the advising office (OASIS) 314-516-5937 in the College of Education to verify coursework.

Physics Core:	Credits
PHYSCS 2111 Mechanics and Heat	5
PHYSCS 2112 Electricity, Mag. & Optics	5
PHYSCS 3200 Mathematical Methods	3
PHYSCS 3231 Modern Physics	3
PHYSICS 4347 Intro to Biophysics	<u>4</u>
Total Physics Core	20
Associated Science Area:	
CHEM 1111 Intro Chemistry I	5
BIOL 1831 From Molecules to Organisms	5
BIOL 1821 or 1202 or 2102 or CHEM 1011	3-5
(Must take 1821 for unified option)	
GEOL 1001 or 1001A General Geology	3-4
or ASTRON 1011	
PHIL 3380 Philosophy of Science	<u>3</u>
Total A.S. Area	19-22
Math Area:	
MATH 1030 College Algebra	3
MATH 1035 Trigonometry	2
MATH 1800 Calculus I	5
MATH 1900 Calculus II	5
MATH 2000 Calculus III	5
MATH 2020 Differential Equations	<u>3</u>
Total Math Area	23
Total Credits for Physics Certification	62-65*
Unified Science Option (Additional Courses)	
ATM SCI 1001/1001A Elem. Meteorology	3-4
CHEM 1011 Environmental Chemistry	3
(or equivalent env. sci. course)	3
PHYSCS 4341 Thermal & Statistical Physics	<u>3</u>
PHYSCS 4331 Quantum Mechanics	12-13
Total Additional Unified**	
Total Proposed Physics Unified**	76-78*

*12 credit hours overlap with Gen Ed requirements (3 math proficiency, 9 science/math).

*Does not include Education coursework or other Gen Eds.

**Unified option enables teachers to teach physics plus introductory biology and chemistry.

For students majoring in Physics (or other STEM fields), there is also the option of obtaining Master's Level teaching certification via the Graduate School and College of Education's Teach in 12 program. Contact the advising office (OASIS) 314-516-5937 in the College of Education or visit the Teach in 12 website: <u>http://coe.umsl.edu/advising/t12/</u>

For questions regarding pathways to STEM teaching certification please contact Nicolle von der Heyde (We Teach MO) at vonderheyden@umsl.edu, or Dr. Chuck Granger at grangerch@umsl.edu.

VII. COURSE DESCRIPTIONS

Prerequisites may be waived by consent of the instructor.

ASTRONOMY

1001 Cosmic Evolution/Introductory Astronomy (4)

Overview of astronomy, from the planets to the Big Bang. Topics include the celestial motions, planets and the formation of the solar system, stars and stellar evolution, galaxies, and cosmology. Students will be introduced to the latest discoveries and how they affect our understanding of the universe. The format is three classroom hours and one 2-hour laboratory session per week to enhance lecture material.

1001A Cosmic Evolution/Introductory Astronomy (3)

Same as ASTRON 1001 without the laboratory.

1011 Planets and Life in the Universe (3)

Man's concept of the solar system from Stonehenge to Einstein; geology and meteorology of the planets of our solar system, with particular attention to results from the space program; exobiology-study of the possibilities of life on other worlds and the best method of communicating with it. Three lecture hours per week.

1012 The Violent Universe and the New Astronomy (3)

A nontechnical course focusing on recent results which larger telescopes and the space program have made available. Pulsars, x-ray stars, and black holes; radio astronomy, our galaxy, and interstellar molecules; exploding galaxies and quasars; origin of the expanding universe. Three lecture hours and one observing session per week.

1050 Introduction to Astronomy I (3)

Prerequisites: Mathematics 1030 and 1035. A survey of the history of astronomy from the ancient times to present. Theories for the formation and evolution of the solar system. The general features of the solar system and planetary motions are discussed. The physical concept of gravity is presented. The detailed properties of the planets, comets, and asteroids are reviewed, concentrating on recent results from space missions. Three classroom hours per week.

1051 Introduction to Astronomy II (3)

Prerequisites: Mathematics 1030 and 1035. A survey of astronomy beyond the solar system. Topics include stars and stellar evolution, neutron stars, and black holes. The physical concept of light and the design of telescopes is discussed in detail. The structure of the Milky Way Galaxy and the large scale structure of the universe are explored. Dark matter, quasars, and active galactic nuclei are discussed in the context of theories for the formation and evolution of the universe. Course does not need to be taken in sequence with Astronomy 1050. Three classroom hours per week.

1121 The Search for Extraterrestrial Life (3)

Prerequisite: Astron 1001 or 1011. Are we alone? The possibility of life in the universe in addition to our own will be explored. Our discussion of the chances for extraterrestrial life will be built around the current theories of chemical, biological, and cultural evolution, which have led to our own technological civilization on Earth. Strategies for communication with extraterrestrial intelligence will be discussed.

4301 Astrophysics (3)

Prerequisite: Physics 3231 or consent of instructor. A moderately technical instruction to astrophysics. Topics will include: physics of stellar interiors and atmospheres; interpretation of stellar spectra; stellar evolution; radio astronomy; and cosmology.

4322 Observational Astronomy (4)

Prerequisites: ASTRON 1050, ASTRON 1051, and PHYSICS 3231 or consent of instructor. Tools of the astronomer: telescopes, spectroscopy, photoelectric photometry. Students will work on a number of projects which will enable them to develop expertise in obtaining, reducing, and analyzing astronomical observations. Student night observing will be an important part of the course. This course is primarily for persons who are astronomy or physics majors or who have some equivalent astronomical background.

ATMOSPHERIC SCIENCE

1001 Elementary Meteorology (4)

Prerequisite: Math 1020 or equivalent. An elementary course covering atmospheric phenomena, weather, and climate. Topics included are temperature, pressure, and moisture distributions in the atmosphere and dynamical effects such as radiation, stability, storms, and general circulation. Four classroom hours per week with one hours being a learning enhancement session to include demonstrations and exercises on problems solving.

1001A Elementary Meteorology (3)

Same as Atmospheric Science 1001 without the learning enhancement session.

1002 Earth Climate Studies (3)

Prerequisite: MATH 1020 or equivalent. This course covers the physical foundations of the Earth's climate system, scientific evidence for climate change and its causes, and the effects of climate change on the ecosystem of the Earth. This course satisfies the information literacy general education requirement.

GEOLOGY

1001A General Geology (3)

It covers Earth materials (minerals and rocks) and processes that shape the Earth such as: volcanism, plate tectonics, earthquakes and seismology (the scientific study of earthquakes and the Earth's interior), weathering and soil, streamflow, stream erosion and deposition, and groundwater and the formation of caves. Geologic hazards such as mass wasting (landsliding) and floods will be discussed, as well as the impact of human activites upon them. Geological resources such as ore minerals and fossil fuels will be covered. The environmental consequences of human activities, such as soil erosion, groundwater pollution and the use of fossil fuels will also be explored.

1001 General Geology Laboratory(1)

Laboratory involves identification of common rocks and minerals.

1002A Historical Geology (3)

Earth history and the history of life on Earth. It begins with how we know what has occurred in the past, including: methods of relative and absolute dating (such as the use of radioactive elements to date rocks), what fossils are, how they form, and what can they tell us about past life, and the basics of organic evolution. Next, we discuss the process of plate tectonics that has helped to shape this planet,

and finally, the rest of the semester deals with the history of the Earth from its formation about 4.5 billion years ago through the end of the last Ice Age about 10,000 years ago, including the origin and evolution of life during Earth's history.

1002 Historical Geology Laboratory(1)

Laboratory primarily involves methods of relative dating and correlation of rocks, and description and identification of fossils.

1053 Oceanography (3)

The atmospheric and ocean circulations; the chemistry and geology of the deep sea; and their effects on the distribution of marine organisms.

PHYSICS

1001 How Things Work (3)

Provides a practical introduction to understanding common life experiences by using physical intuition and basic ideas of physics. Powerful scientific principles are demonstrated through topics ranging from airplane wings to compact disk players, from lightning strikes to lasers.

1011 Basic Physics I (3)

Prerequisites: Math 1030 and Math 1035; Math 1100 or Math 1800 strongly recommended. A course specifically designed for students in health and life sciences covering the topics in classical mechanics such as kinematics, Newton's laws, energy, momentum and oscillations. This course will not fulfill the Physics 2111 requirement for physics, chemistry, and engineering majors. Three classroom hours per week.

1011L Basic Physics I Laboratory (1)

Laboratory portion of PHYS 1011. Two laboratory hours per week.

1012 Basic Physics II (3)

Prerequisites: Physics 1011. A continuation of Physics 1011. A course specifically designed for students in health and life sciences covering electricity, magnetism, light, optics and waves. This course will not fulfill the Physics 2112 requirement for physics, chemistry, and engineering majors. Three classroom hours per week.

1012L Basic Physics II Laboratory (1)

Laboratory portion of PHYS 1012. Two laboratory hours per week.

1050 Introduction to Physics (4)

Prerequisite: Math 1030. A laboratory survey course which introduces students to the fields of mechanics, heat and thermodynamics, optics, electricity and magnetism, and modern physics at the pre-calculus level. A problem-solving course, recommended for science and engineering students who have no physics background or who desire additional preparation for Phys 2111. Three classroom hours and two hours of laboratory per week.

1099 Windows on Physics (1)

A seminar designed to introduce physics majors to research areas in physics and physics-related fields in the Department of Physics & Astronomy. In addition to fundamental areas of physics, the areas of astrophysics, biophysics, materials science, and nanotechnology will be included. Career opportunities for students with physics degrees will be discussed and the physics curriculum will be reviewed. The course meets weekly and is required of all physics majors and minors who are first-time freshmen or transfer students.

2111 Physics: Mechanics and Heat (4)

Prerequisite: Mathematics 1900 (may be taken concurrently). Physics 1001, or Chemistry 1121, or equivalent is recommended. An introduction to the phenomena, concepts, and laws of mechanics and heat for physics majors and students in other departments. Three hours of lecture amd one hour of discussion per week.

2111 Physics: Mechanics and Heat Laboratory (1)

Laboratory portion of PHYS 2111. Two laboratory hours per week.

2112 Physics: Electricity, Magnetism, and Optics (4)

Prerequisites: PHYS 2111 and MATH 2000. (MATH 2000 may be taken concurrently). A phenomenological introduction to the concepts and laws of electricity and magnetism, electromagnetic waves, optics and electrical circuits for physics majors and students in other departments. Three hours of lecture and one hour of discussion per week.

2112 Physics: Electricity, Magnetism, and Optics Laboratory (4)

Laboratory portion of PHYS 2112. Two laboratory hours per week.

3200 Mathematical Methods of Theoretical Physics (3)

Prerequisites: Physics 2112 and Mathematics 2000. Mathematical techniques specifically used in the study of mechanics, electricity, magnetism, and quantum physics are developed in the context of various physical problems. Course includes the topics of vector calculus, coordinate systems, the Laplace equation, and its solutions, elementary Fourier analysis, & complex variables. Applications to electrostatics, mechanics, and fluid dynamics are emphasized. Three hours of lecture per week.

3221 Mechanics (3)

Prerequisites: Physics 3200 and Mathematics 2020. (Math 2020 may be taken concurrently). Advanced course covering single and many particle dynamics, rigid-body dynamics, and oscillations. Variational principles and Hamiltonian formulations of mechanics are covered. Three hours of lecture per week.

3223 Electricity and Magnetism (3)

Prerequisites: Physics 3200 and Mathematics 2020. (Math 2020 may be taken concurrently). Advanced course covering the rigorous development, from basic laws, of Maxwell's equations for electromagnetic fields along with applications of these equations. Topics covered are electrostatics and electrodynamics including currents, magnetic fields, motion of charged particles in fields and an introduction to electromagnetic waves. Three hours of lecture per week.

3231 Introduction to Modern Physics I (3)

Prerequisite: Physics 2111, 2112, and Mathematics 2020 (typically taken concurrently) and Physics 3200 strongly recommended (but is typically taken concurrently). Students typically take Math 2020, Physics 3200 and 3231 in the same semester (see Tentative Schedules above). Photons and the wave nature of particles; wave mechanics, Schroedinger equation, and applications to single system; atomic physics and spectroscopy; molecular physics; nuclear models and reactions; the physics of solids; elementary particles; relativity. Three hours of lecture and one discussion section per week.

3281 Directed Readings in Physics (1-5)

Prerequisite: Consent of instructor. A study of the literature of physics. A paper is required on an approved topic. Topics must be substantially different from regular courses. Hours arranged.

3390 Research (1-10)

Prerequisite: Consent of department. Independent research projects arranged between student and instructor. Hours arranged.

3410 Seminar (1)

Presentation of selected papers by students and faculty members at weekly meeting. May be taken twice for credit.

4306 Nanoscience Practicals (1-3)

Prerequisite: Consent of Instructor (1.0 credit hour per module with a maximum of 3 credit hours) Studies of nanoscience characterization, synthesis, and modeling techniques designed for clients of these tools, as well as for technical users interested in a current overview. Course consists of a set of 1/3 semester modules. Check with the instructor on more specialized modules (e.g. on materials microscopy) if interested. Each module will cover instrumentation, current applications, weaknesses, and will involve lab visits for hands-on experience, weekly web interaction and classroom hours.

4308 Transmission Electron Microscopy (3)

Prerequisite: consent of instructor. Course introduces students to transmission electron microscopy techniques and their applications to solving challenging materials and biological problems. Course includes fundamental principles (electron optics), electron-specimen interactions, diffraction of electrons, image formation and interpretation, image processing and analysis, energy dispersive X-ray spectroscopy, electron energy loss spectroscopy, and sample preparation of both biological and non-biological systems. Laboratory experiments will provide students "hands-on" experience with TEM operations and problem-solving skills. Successful completion of the course enables students to independently operate transmission electron microscopes to perform basic research experiments. This course is ideal for students interested in ultrastructural or nanocharacterization of biological or materials systems. Two classroom hours and two hours of laboratory per week.

4309 Scanning Probe Microscopy (3)

Prerequisite: consent of instructor. A lecture/laboratory study of research techniques using scanning probe microscopy. Topics include atomic force microscopy, scanning tunneling microscopy, feedback control, scanning tip fabrication, scan calibrations, air/solution/vacuum imaging, image processing and analysis, near-field optical probes, metrology, and lateral force/displacement microscopy. Applications in physics, chemistry, biology, engineering, and surface science are discussed. Two classroom hours and two hours laboratory per week.

4310 Modern Electronics (3)

An integrated recitation/laboratory study of modern analog and digital electronics with emphasis on integrated circuits. Topics include circuit elements, operational amplifiers, logic gates, counters, adc/dac converters, noise reduction, microprocessors, embedded microcontrollers, and digital processing. Six hours of laboratory per week.

4311 Advanced Physics Laboratory I (3)

Prerequisites: Advanced standing with at least nine completed hours of Physics at or above the 3000 levels. Physics majors are introduced to the experimental techniques used in research. A student will choose and do several special problems during the semester. Six hours of laboratory per week.

4323 Modern Optics (3)

Prerequisite: Physics 3223. A study of modern optics including diffraction theory, polarization, light propagation in solids, quantum optics, and coherence.

4325 Topics in Modern Applied Physics (3)

Prerequisites: Physics 4310 and Mathematics 2020. Topics are taken from modern applications of physics, which may include linear analysis, nonlinear analysis, Fourier transform spectroscopy, wavelet analysis, noise and fluctuation phenomena, material science, physical electronics, optical techniques, and scanning tip microscopy.

4331 Introduction to Quantum Mechanics (3)

Prerequisites: Physics 3200 and 3231. Introduction to the mathematical structure and applications of non-relativistic quantum mechanics. The course covers Hilbert space and operators on Hilbert space; Dirac notation; spin-1/2 particles and angular momentum; the Schrodinger equation; single particle 1D problems including the harmonic oscillator and scattering; approximation methods.

4335 Atomic and Nuclear Physics (3)

Prerequisites: Physics 4331. Application of Schroedinger's equation to hydrogen-like atoms; atomic structure and spectra; nuclear masses, energy levels; alpha, beta, and gamma radiation, nuclear reaction, and models of the nucleus.

4341 Thermal and Statistical Physics (3)

Prerequisites: Mathematics 2000 and Physics 3231. Introduction to statistical mechanics, classical thermodynamics, and kinetic theory.

4343 Selected Topics in Physics I (3)

Prerequisites: Physics 3221, 3223, 3231, 4341. Topics include special phenomena from research areas such as physics of waves, biophysics, nonlinear physics, geophysical fluid dynamics and the atmospheric sciences treated by methods of advanced mechanics, electromagnetism, statistical mechanics, thermodynamics and quantum mechanics. Three hours of lecture per week.

4347 Introduction to Biophysics (4)

Prerequisites: PHYSICS 3231, BIOL 1821, and BIOL 1831; or permission of instructor. Introduction to the application of physical principles to problems in biology. The course will cover topics such as ion transport, protein folding, molecular motors, collective dynamics and self-assembly of biological systems, x-ray crystallography and NMR, a survey of medical imaging techniques, the relation between nonlinear dynamics and electrophysiology in the heart and brain, and physics-based approaches to modeling gene networks and evolutionary dynamics.

4350 Computational Physics (3)

Prerequisite: CS 1250, plus Phys 3221, 3223, and 3231. Numerical and computational methods in physics. Particle trajectories using advanced methods for ordinary differential equations, including adaptive Runge-Kutta. Experimental data analysis, including curve fitting, statistical and spectral analysis. Solution of the Schroedinger, diffusion, and Poisson's equations using implicit and explicit methods for partial differential equations. Stochastic methods for kinetic theory, and Monte Carlo optimization. Three classroom hours per week.

4351 Elementary Solid State Physics (3)

Prerequisite: Physics 4331. Theoretical and experimental aspects of solid state physics, including onedimensional band theory of solids; electron emission from metals and semiconductors; electrical and thermal conductivity of solids.

4353 Physics of Fluids (3)

Prerequisites: Physics 3221, 3223, and 4341, or consent of instructor. Dynamical theory of gases and liquids. Course covers the mathematical development of physical fluid dynamics with contemporary applications.

4354 Atmospheric Physics (3)

Prerequisite: Physics 4341 and 3221. The mathematical application of physical laws to atmospheric dynamics and physical meteorology. Application of mechanics, thermodynamics, optics and radiation to atmospheric phenomena including the ionosphere.

4356 Quantum Optics (3)

Prerequisites: Physics 3200, 3231, and Mathematics 2020. Review of atomic theory and spectroscopy. Selected applications to modern optical phenomena such as optical pumping, lasers, masers, Mossbauer effect, and holography.

4365 Introduction to Plasma Physics (3)

Prerequisites: Physics 3223 and 4341. A study of the nonlinear collective interactions of ions, electrons, and neutral molecules with each other and with electric and magnetic fields. Topics include plasma confinement and stability, electrical discharges and ionization, kinetic theory of plasma transport, plasma waves and radiation, and controlled fusion. Solutions of the Boltzmann, Fokker-Planck, and Vlasov equations are discussed and methods of advanced electronmagnetism and statistical physics are utilized.

4370 Relativity & Cosmology (3)

Prerequisites: Physics 3221, 3223, and 3231. An introduction to Einstein's general theory of relativity. Topics will include special relativity in the formalism of Minkowski's four dimensional space-time, Principle of Equivalence, Riemannian geometry and tensor analysis, Einstein field equation and cosmology.

4381 Directed Readings in Physics (1-10)

Prerequisite: Consent of instructor. An independent study of special topics in physics for senior undergraduates or graduate students.

Some undergraduates may be eligible to take graduate-level courses for elective credit. Please see your advisor for details.

5402 Introduction to Mathematical Physics (3)

Prerequisites: Graduate standing in Physics or consent of instructor. A course covering mathematical techniques as applied in advanced theoretical physics including generalized vector spaces and their dual spaces, linear operators and functionals, generalized functions, spectral decomposition of operators, tensor analysis, and complex variables. Three classroom hours per week.

5403 Principles of Mathematical Physics (3)

Graduate standing in physics or consent of instructor. Boundary value problems; Sturm-Liouville

theory and orthogonal functions; Green's function techniques; and introduction to group theory with emphasis on representations of Lie Algebras. Three classroom hours per week.

5307Advanced Scanning Electron Microscopy (3)

Prerequisite: Consent of instructor. This course introduces students to advanced scanning electron microscopy techniques and their applications to solving challenging materials and biological problems. The course includes electron optics, electron-specimen interactions, image formation and interpretation, compositional analysis by energy dispersive X-ray spectroscopy, and sample preparation of both biological and non-biological systems. Laboratory experiments will provide students "hands-on" experience with SEM operations and problem-solving skills. Successful completion of the course enables students to independently operate scanning electron microscopes to perform research experiments. Two classroom hours and two hours of laboratory per week.

5345 Nonlinear Dynamics and Stochastic Processes (3)

Prerequisites: Phys 3221 and 4341 and Consent of Instructor. Dynamical systems; theory of oscillations; introduction to bifurcation theory and chaos in dissipative systems with applications in physics and biology; introduction to stochastic processes with applications in physics, chemistry and biology; dynamics of nonlinear systems perturbed by noise; noise-induced phase transitions; linear and nonlinear time series analysis. Three classroom hours per week.

5357 Fundamental Particles and Forces (3)

Prerequisites: Physics 3223, 3231 and 4331. Introduction to nuclear and particle physics. Nuclear phenomenology and models; high energy particle accelerators and detectors; phenomenology of strong, electromagnetic and weak interactions; symmetry principles; quark compositions of strongly interacting baryons and mesons; gauge theories and the standard model of particle interactions; grand unification.

VIII. SCHOLARSHIPS, AWARDS, AND FINANCIAL SUPPORT

The Department of Physics and Astronomy offers a number of scholarships and awards, as well as financial support to Physics majors. Money from all scholarships and awards are transferred to individual student accounts and may be applied to tuition and fees. For more information, contact the Undergraduate Advisor (bahars@umsl.edu).

(1) PHYSICS & ASTRONOMY ALUMNI SCHOLARSHIP

New Physics majors with outstanding ACT or SAT scores, or continuing Physics majors with outstanding academic records, are eligible to receive up to \$2,000 per academic year. This scholarship may be renewed for up to 4 years provided the recipient maintains a 3.5 GPA. Applications for this scholarship should include an official grade transcript, an official listing of ACT or SAT scores, and a letter of reference from a present or former physics teacher. Application materials should be sent to the Department Chairperson or the Undergraduate Advisor by May 1. Students receiving the Alumni Scholarship are not eligible for the Junior Alumni Award.

(2) THE RICHARD D. SCHWARTZ SCHOLARSHIP FOR PHYSICS MAJORS

The Richard D. Schwartz scholarship, available to full-time junior/senior physics majors in good standing and renewable for up to two years, provides \$2,000 per academic year. Applications are due by May 1 and must be from Missouri residents. The scholarship is named in honor of Professor Schwartz who had a distinguished 28 year career at the University of Missouri-St. Louis that included oversight of the construction of the campus observatory and implementation of the astrophysics option program. Professor Schwartz was a pioneer in the study of the energetic winds from young stars and was a premier observational astronomer, using such facilities as the Hubble Space Telescope, the International Ultraviolet Explorer, and the Kuiper Airborne Observatory. He authored over 75 scientific publications and was selected to receive the Chancellor's Award for Excellence in Research in 1999.

(3) DON C. AND SUSAN P. WINTER ENDOWED SCHOLARSHIP IN PHYSICS & ASTRONOMY. To be eligible for this award, students must be full-time undergraduates interested in pursuing a degree in physics. The requirements for eligibility are a minimum ACT of 24 (for incoming freshmen) or minimum GPA of 3.0. The award is renewable as long as student continue to meet these criteria. Please contact the department regarding the amount of the award (which may vary) and the application process.

(4) PIERRE LACLEDE/PHYSICS & ASTRONOMY ALUMNI SCHOLARSHIP FOR UNDERGRADUATE PHYSICS MAJORS

Physics majors who are also accepted into the Pierre Laclede Honors College may be eligible for a joint Physics & Astronomy Alumni / Pierre Laclede Honors College Scholarship. The award includes up to \$1500 per year from the Department of Physics & Astronomy. In addition, the Pierre Laclede Honors College will add up to a \$2000 merit scholarship to make a total award of up to \$3500 annually. The full scholarship is renewable for up to four years for freshman awardees who maintain a 3.5 GPA. Students should contact the Honors College advising office for instructions on how to apply.

(5) JUNIOR ALUMNI AWARD

Physics majors who attain a 3.5 average or better in Physics 2111 and 2112 are entitled to receive this award. The award, generally \$500, is given to the student in the semester they enroll in Physics 3200. Transfer students must take Physics 2112 on this campus to be eligible for this scholarship.

(6) SENIOR ALUMNI AWARD

This award is given to an outstanding Physics major at the senior level (must earn highest GPA among the senior class) and the amount is generally \$500.

(7) JEFFREY EARL AWARD

The Department awards a cash prize (typically \$500) to an outstanding graduating senior every May.

(8) UNDERGRADUATE RESEARCH AWARDS

Undergraduate physics majors who identify a faculty mentor and research project may apply for a research award up to \$1000 for two semesters. Students receiving this award are required to enroll for at least one credit hour of Physics 3390 and present their research results at the campus Undergraduate Research Symposium in April.

(9) TEACHING ASSISTANTSHIPS

A small number of student teaching assistantships with stipends are available to qualifying students to prepare them for the independent effort required in industry or graduate school. Students are encouraged to talk to professors or the Chairperson about these opportunities.

(10) NASA RESEARCH INTERNSHIP

Research internships for the summer and academic year are available for students interested in astrophysics through the NASA/Missouri Space Grant Consortium.

(11) FINANCIAL AID

The university offers financial assistance to qualifying students in the form of grants, loans, scholarship, and work-study. Complete information on all available financial aid programs is found in the *Financial Aid Brochure*. Contact the Student Financial Aid Office to obtain a copy.

IX. THE PHYSICS CLUB

The Physics Club on the UM-St. Louis campus was formed in 1971 and continues strong today. It is the glue that holds the life of a physics student together. Through the Physics Club you get to meet all the other physics students, from freshmen through seniors, and on to graduate students. You socialize, network, share information, get help, give help, improve the Department of Physics and Astronomy with in-house projects, and do outreach projects. You learn from each other, and have a lot more fun than you would just going it alone.

The Physics Club holds monthly planning meetings, which include a free pizza lunch. It also holds a minimum of one fun social event per month, open to all physics students and their friends and family. Examples of these social events include: dining out together, taking trips to local science sites, and holding movie nights here on campus. The club also does projects that promote physics to non-physicists, both on our campus and in the larger community.

Our local Physics Club is associated with a national student physics organization, the Society of Physics Students (SPS). This professional physics association, designed explicitly for students, consists of 600 active chapters across the United States. The national SPS provides us with opportunities to participate in national and regional research meetings, where we can present papers and network informally with students from across the country. Some students in our Physics Club opt to join the national SPS for a small fee. These students receive *Physics Today* magazine, the *Journal of Undergraduate Research in Physics* and the *SPS Newsletter*. The SPS also offers scholarships for projects that promote interest in physics among non-physics majors and the general public.

You become a member of the Physics Club automatically, simply by registering as a physics major or minor. To assure that you are on the email list and that you will receive the club notices, you may email the club's faculty sponsor, Dr. Wilking at <u>bwilking@umsl.edu</u>. But most students will be automatically put on the list without having to take any action of their own.



Front to back, left to right – Keara Wright, Amber Anders, Dr. Wilking, Paul Dalba, Zak Jost, David Coss, Melissa Pastorius and Dr. Gibb

X. TRANSFER CREDITS

Students transferring into the Department of Physics & Astronomy from other colleges/universities may seek assistance from the Chair of the Department to effect as smooth a transition as possible. Here are the criteria for transfer credits:

(1) All astronomy and geology courses from reputable universities, colleges, and junior colleges will receive Natural Science and Mathematics credits.

(2) Only Physical Science courses with a mathematics requirement receive General Education Natural Science and Mathematics credit.

(3) There are two exceptions to (2); Physical Sciences 101 and 124 offered by the St. Louis Community College receive Natural Science and Mathematics credits.

(4) Physical Science courses without a mathematics requirement or courses with titles like "Physics and Society" or "Energy and Environment" do not satisfy the Natural Science and Mathematics distribution requirement. These courses can be transferred as Approved Elective credits and be used to fulfill the 120 hours needed for graduation.

(5) Students who have earned an Associate of Science Degree: Physics Option at one of the St. Louis Community Colleges have an opportunity to complete their Bachelor of Science Degree in Physics at UM-St. Louis. This matriculation agreement is tailored for students seeking a B.S. in Physics: Engineering Physics option. Students can transfer a maximum of 64 credit hours from their Associates Degree to UM-St. Louis and will have to take a minimum of 36 credit hours in upper division physics and mathematics at UM-St. Louis (plus any remaining general education requirements) to complete the B.S. in Physics: Engineering Physics Option degree. Alternatively, students can complete a B.S. in Physics: Astrophysics Option with a minimum of 40 credit hours of upper division physics and mathematics, or a B.S. in Physics: General Physics Option with a minimum of 47 credit hours.

XI. CAREER OUTLOOK

Many of our students have been successful in subsequent graduate studies in astrophysics and meteorology, as well as physics. Our alumni have pursued graduate studies and earned doctorate degrees at institutions such as Cornell University, MIT, University of Wisconsin, University of Chicago and Washington University. Students who have elected for careers in industry are now working in a variety of settings for such firms as Emerson Electric, AT&T, Hewlett Packard, IBM, Boeing and MEMC Electronic Materials (SunEdison). Several former students are currently teaching physics in high schools around the St. Louis area.

