

PROGRAM CHANGES
WEBER STATE UNIVERSITY

Submission Date:

College: Science

Department: Physics

Program Title: Physics Major (BS degree)

PROGRAM DESCRIPTION:

The Physics BS program gives students a thorough understanding of the fundamental laws of nature. It also develops students' skills in mathematical problem solving and experimental design and interpretation. This program prepares students for graduate study in physics or a closely related field, or for a wide variety of careers that make use of these skills.

Check all that apply:

New course(s) required for major, minor, emphasis, or concentration.

Modified course(s) required for major, minor, emphasis, or concentration.

Credit hour change(s) required for major, minor, emphasis, or concentration.

Credit hour change(s) for a course which is required for the major, minor, emphasis, or concentration.

Attribute change(s) for any course.

Program name change.

Deletion of required course(s).

Other changes (specify) Revisions allow students to choose among four options within the program

If multiple changes are being proposed, please provide a summary. Use ~~strikeout~~ (strikeout) when deleting items in the program and highlight (highlight) when adding items.

The Physics Department is proposing a thorough update of the Physics BS program, incorporating several course changes and adding new options that emphasize physics of materials, astrophysics, and computational physics. Although the core of the program is unaffected, the new options entail significant changes in upper-division requirements and support courses. Please see attached catalog revision for details. Note that the catalog revisions also entail a nonsubstantive reorganization, separating the Physics, Applied Physics, and Physics Teaching programs into separate sections for clarity.

Submit the original to the Faculty Senate Office, MC 1033, and an electronic copy to kbrown4 @weber.edu

JUSTIFICATION:

The Physics degree program has not undergone significant revision since semester conversion in 1999. The department is now proposing several changes in order to take advantage of current faculty expertise, recent equipment acquisitions, and most importantly, shifting opportunities for employment of our graduates. In recognition of the growing importance of interdisciplinary work, the revised program offers three new specialized options in addition to the traditional option (which emphasizes theoretical course work in preparation for physics graduate study). The new options are in physics of materials, astrophysics, and computational physics.

INFORMATION PAGE

Attach a copy of the present program from the current catalog and a revised version (exactly as you wish it to appear in the catalog).

Did this program change receive unanimous approval within the Department? **Yes**. If not, what are the major concerns raised by the opponents?

Explain any effects this program change will have on program requirements or enrollments in other departments including the Bachelor of Integrated Studies Program. In the case of similar offerings or affected programs, **you should include letters from the departments in question stating their support or opposition to the proposed program.**

Because of the wider range of options within the revised program, there could be some small changes in the number of Physics Major students taking certain courses in Chemistry, Geosciences, Microbiology, Computer Science, and Mathematics. Only about 5-10 students currently major in Physics each year, and each of these changes would affect only a fraction of these students. Thus, the enrollment changes in other departments would not be significant and these departments would not be affected.

Indicate the number of credit hours for course work within the program. (Do not include credit hours for General Education, SI, Diversity, or other courses unless those courses fulfill requirements within the proposed program.)

75 to 82, depending on options chosen.

Indicate the number of credit hours for course work within the current program. (Do not include credit hours for General Education, SI, Diversity, or other courses unless those courses fulfill requirements within the current program.)

75

PROFILE
ENROLLMENT
STUDENT AFFAIRS
ACADEMIC INFO
DEGREE REQ
GEN ED

Engaged Learning

& Interdisciplinary
OUR/CBL
HNRS/BIS
ESL
LIBS
INTRD MINORS

Applied Science & Technology

AUSV/ATTC
CMT
CEET/EE
CS
MFET/ETM
MET
DGET
ENGR
IDT
SST
TBE

Arts & Humanities

MPC/MENG
COMM
ENGL
FL
DANC
MUSC
THEA
ART/ARTH

Business & Econ

MBA
MACC/MTAX
ACTG
BSAD/FIN
MGMT
MKTG
SCM
ECON/QUAN
IST

Education

MSAT/MED
CHF
AT/HLTH
NUTR/PEP/REC
HPHP COURSES
ATHL/PE
EDUC

Health Professions

MHA/MSN
MSRS
DENT
PAR
HTHS
HAS/HIM
MLS
NRSNG
RADT
DMS/NUCM
RATH
REST

Science

BTNY
CHEM
GEO
MATH/MTHE
MICR
PHYS/ASTR
ZOO

Social & Behavioral Sciences

MCJ/CJ
ECON
GEOG
HIST
POLS/PHIL
PSY
SW/GERT
SOC/ANTH
AERO
MLS
NAVS

Continuing Ed**Davis Campus**

classroom discussion, laboratories, and field trips. Prerequisite: CHEM PS1210 or approval of the instructor.
Cross-listed with GEO 3753.

MICR 3853. Food Microbiology (3) F

Role of microorganisms in food production, preservation, and spoilage. Two lectures and one 2-hour lab per week. Prerequisite: MICR LS2054.

MICR 4054. Microbial Physiology (4) F

Structure, function, and metabolism of microorganisms, with emphasis upon the bacteria. Three lectures and one 3-hour lab per week. Prerequisite: MICR LS2054 and completion of or concurrent registration in CHEM 3070.

MICR 4154. Microbial Genetics (4) Sp

Genetics of microorganisms and its applications, including mutation, gene transfer systems, recombination, plasmids, recombinant DNA technology, and transposons. Three lectures and one 3-hour lab per week. Prerequisite: MICR LS2054. CHEM 3070 recommended.

MICR 4252. Cell Culture (2) Sp (cross-listed with Botany)

Basic methods and applications for culturing plant and animal cells in vitro. Two 2-hour combined lecture and laboratory sessions per week. Prerequisite: MICR LS2054 or BTNY 2104 and BTNY 2121.

MICR 4354. Industrial Microbiology and Biotechnology (4) Sp

Beneficial and detrimental involvement of microorganisms in industrial processes, microbial products, biotechnology, contamination control, and antimicrobial agents including antibiotics. Three lectures and one 3-hour lab per week. Prerequisites: MICR LS2054, CHEM 2310 or CHEM 3070. MICR 3053 recommended.

MICR 4554. Virology (4) Sp

Virus structure, classification, genetics, replication and other interactions with the host, with emphasis on bacteriophage and animal viruses. Three lectures and one 3-hour lab per week. Prerequisite: MICR LS2054.

MICR 4570. Secondary School Science Teaching Methods (3)

Acquaintance and practice with various teaching and assessment methods. Development of science curricula including lesson and unit plans. It is recommended that this course be completed immediately before student teaching. Prerequisite: Admission to the Teacher Education Program.

MICR 4800. Directed Research (1-2) Su, F, Sp

Independent research under the advisement of a faculty member. Prerequisite: consent of instructor and a minimum of 6 credits of upper division microbiology course work.

MICR 4830. Directed Readings (1-2) Su, F, Sp

Independent readings on advanced special topics under the direction of a faculty member. Prerequisite: consent of instructor and a minimum of 6 credits of upper division microbiology course work.

MICR 4890. Cooperative Work Experience (1-5) Su, F, Sp
(See MICR 2890 for description.)**MICR 4920. Short Courses, Workshops, Institutes and Special Programs (1-3)**

Consult the semester class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

MICR 4991. Microbiology Seminar (1) F, Sp

Current topics in Microbiology. One hour per week. Prerequisites: Previous upper division courses in the department.

MICR 5034. Microbiology for Teachers (4)

Science content course for teachers in the MED Science Emphasis Program.

DEPARTMENT

PHYSICS

Chair: Dr. Brad Carroll

Location: Science Lab, Room 202

Telephone: Nereyda Hesterberg 801-626-6163

Web Site: weber.edu/physics

Professors: Farhang Amiri, Brad Carroll, Ronald Galli, Colin Inglefield, Adam Johnston, Dale Ostlie, Daniel Schroeder, John Sohl, Walther Spjeldvik; **Associate Professors:** Michelle Arnold, Stacy Palen; **Assistant Professor:** John Armstrong,

Physics is the study and application of the fundamental laws of nature, including the laws of motion, gravity, electromagnetism, heat, and microscopic interactions. These laws govern the behavior of objects at all scales, from the smallest subatomic particles to the entire observable universe. In between, physicists study nuclear reactions, the interactions of atoms with light, properties of solids, the chaotic dynamics of fluids, and the evolution of stars and galaxies, among many other applications.

Our courses in physics introduce all of the most important fundamental laws and many of their applications. Equally valuable, however, are the skills that students develop in these courses, from analytical thinking and problem solving to experimental design and interpretation. Majoring in physics can thus prepare a student for a variety of careers in research, education, business, industry, and government.

The Department offers three major programs: Physics, Applied Physics, and Physics Teaching. The Physics major places emphasis on understanding nature at the deepest possible level. ~~It also provides a strong foundation for graduate work in pure physics.~~ The Applied Physics major places more emphasis on physical phenomena and hands-on experience. Thus, it is more suitable for those planning to go either directly into industrial employment or into graduate programs in certain applied fields. ~~Since the course requirements for these two majors overlap considerably, students can easily switch from one major to the other any time before their senior year.~~ The Physics Teaching major is designed specifically for those planning to teach physics at the secondary school level.

Students who are majoring in other disciplines are encouraged to consider a minor in physics, which includes a year of introductory physics plus eight credit hours of additional physics courses. These electives may be chosen to emphasize basic theory, experimental techniques, or applied subfields such as optics and astrophysics.

PHYSICS MAJOR**BACHELOR'S DEGREE (BS)**

~~» Program Prerequisite: Not required for Physics or Applied Physics. Physics Teaching majors must meet the Teacher Education admission and licensure requirements (see Teacher Education Department).~~

~~» Minor: No minor is required; however, a math minor is automatically satisfied by the requirements for the Physics major, and a math minor may be satisfied with one additional upper division math course beyond the minimum required for the Applied Physics major.~~

~~» Grade Requirements: An overall GPA of 2.00 is required for Physics and Applied Physics majors. Also refer to the general grade requirements for graduation on page 38.~~

~~» **Credit Hour Requirements:** A total of 120 semester credit hours is required for graduation; 75 of these are required within the Physics major, 72 within the Applied Physics Major, and 45 hours are required within the Physics Teaching major, plus the credits required by the Teacher Education department. Forty upper-division credit hours are required (courses numbered 3000 and above); 31 of these are required within the Physics major and 26 to 31 within the Applied Physics major.~~

Advisement

~~All Physics, Applied Physics, and Physics Teaching majors are strongly encouraged to meet with the chair at least annually for course and program advisement. Call 801-626-6163 for more information or to schedule an appointment. Physics Teaching majors are encouraged to also meet with a Jerry and Vickie Moyes College of Education advisor (call 801-626-6269).~~

Admissions Requirements

~~Declare your program of study (see page 18). There are no special admission or application requirements for the Physics and Applied Physics majors. Teaching majors must meet the Teacher Education admission and licensure requirements (see Teacher Education Department).~~

General Education

~~Refer to pages 38-43 for Bachelor of Science requirements. The following courses required for the Physics and Applied Physics majors will satisfy general education requirements: PHYS PS2210, CHEM PS1210 and MATH 1210. The following courses required for the Physics Teaching Major will satisfy general education requirements: PHYS PS1010, PS1030, PS2210, and Math1210.~~

Physics Major Course Requirements for BS Degree

~~Physics Courses Required (41 credit hours)~~

PHYS PS2210/2220	Physics for Scientists & Engineers (10)
PHYS 2300	Scientific Computing for Physical Systems (3)
PHYS 2710	Introductory Modern Physics (3)
PHYS 3180	Thermal Physics (3)
PHYS 3410	Electronics for Scientists (4)
PHYS 3500	Analytical Mechanics (3)
PHYS 3510	Electromagnetic Theory (3)
PHYS 3540	Mech. & Electromagnetic Waves (3)
PHYS 3640	Advanced Physics Lab (2)
PHYS 4610	Quantum Mechanics (3)
PHYS 4620	Atomic, Nuclear, & Particle Physics (3)
PHYS 4990	Seminar in Physics (1)

~~Physics Electives (3 credit hours)~~

~~Select 3 credit hours from the following 3000 and 4000 level courses.~~

PHYS 3160	Astrophysics (3)
PHYS 3190	Applied Optics (3)
PHYS 3200	Solid State Physics (3)
PHYS 3300	Advanced Computational Physics (3)
PHYS 3420	Data Acquisition and Analysis (3)
PHYS 4800	Individual Research Problems (1-3)
PHYS 4830*	Readings in Physics/Astronomy (1-3)

~~* as approved by instructor~~

PHYS 4970	Senior Thesis (2)
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~~Support Courses Required (31 credit hours)~~

CHEM PS1210/1220	Principles of Chemistry (10)
MATH 1210	Calculus I (4)
MATH 1220	Calculus II (4)
MATH 2210	Calculus III (4)
MATH 2270	Elementary Linear Algebra (3)
MATH 2280	Ordinary Differential Equations (3)
MATH 3710	Boundary Value Problems (3)

Applied Physics Major

Course Requirements for BS Degree

Physics Courses Required (38 credit hours)

PHYS PS2210/2220	Physics for Scientists & Engineers (10)
PHYS 2300	Scientific Computing for Physical Systems (3)
PHYS 2710	Introductory Modern Physics (3)
PHYS 3190	Applied Optics (3)
PHYS 3410	Electronics for Scientists (4)
PHYS 3500	Analytical Mechanics (3)
PHYS 3510	Electromagnetic Theory (3)
PHYS 3540	Mech. & Electromagnetic Waves (3)
PHYS 3640	Advanced Physics Lab (2)
PHYS 4800	Individual Research Problems (3)
PHYS 4990	Seminar in Physics (1)

Physics Electives (9 credit hours)

Select a minimum of nine credit hours with departmental approval from the following

PHYS 2600	Laboratory Safety (1)
PHYS 3160	Astrophysics (3)
PHYS 3180	Thermal Physics (3)
PHYS 3200	Solid State Physics (3)
PHYS 3300	Advanced Computational Physics (3)
PHYS 3420	Data Acquisition and Analysis (3)
PHYS 4610	Quantum Mechanics (3)
PHYS 4620	Atomic, Nuclear & Particle Physics (3)
PHYS 4830*	Readings in Physics/Astronomy (1-3)
* as approved by instructor	
PHYS 4970	Senior Thesis (2)
CEET 1040/1040L	Microprocessor Systems (4)
GEO 4600	Geophysics (3)
CHEM 3410/3420	Physical Chemistry (8)
MATH 3710	Boundary Value Problems (3)

Support Courses Required (25 credit hours)

CHEM PS1210/1220	Principles of Chemistry (10)
MATH 1210	Calculus I (4)
MATH 1220	Calculus II (4)
MATH 2210	Calculus III (4)
MATH 2280	Ordinary Differential Equations (3)

Physics Teaching Major

Course Requirements for BS Degree

Physics Courses Required (25 credit hours)

PHYS PS1040	Elementary Astronomy (3)
PHYS PS2210/2220	Physics for Scientists & Engineers (10)
PHYS 2600	Laboratory Safety (1)
PHYS 2710	Introductory Modern Physics (3)
PHYS 3570	Foundations of Science Education (3)
PHYS 4570	Secondary School Science Teaching Methods (3)
PHYS 4800	Independent Research (1)
PHYS 4990	Physics Seminar (1)

Physics Electives (9 credit hours)

Select nine credit hours in approved Physics classes (courses numbered 2300 and above, excluding other explicit course requirements).

Support Courses Required (11 credit hours)

HIST 3350	History and Philosophy of Science (3)
MATH 1210/1220	Calculus I, II (8)

Students must also complete the Teacher Education Licensure Program.

Suggested Course Sequence

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

[Revised Version of Physics Program Catalog Description]

Physics is the study and application of the fundamental laws of nature, including the laws of motion, gravity, electromagnetism, heat, and microscopic interactions. These laws govern the behavior of objects at all scales, from the smallest subatomic particles to the entire observable universe. In between, physicists study nuclear reactions, the interaction of atoms with light, properties of **materials**, the chaotic dynamics of fluids, and the evolution of stars and galaxies, among many other applications.

Our courses in physics introduce all of the most important fundamental laws and many of their applications. Equally valuable, however, are the skills that students develop in these courses, from analytical thinking and problem solving to experimental design and interpretation. Majoring in physics can thus prepare a student for a variety of careers in research, education, business, industry, and government.

The Department offers three major programs: Physics, Applied Physics, and Physics Teaching. The Physics major places emphasis on understanding nature at the deepest possible level, and offers options that emphasize fundamental theoretical physics, astrophysics, computational physics, and physics of materials. Each of these options provides a strong foundation for graduate work. The Applied Physics major places more emphasis on physical phenomena and hands-on experience. Thus, it is more suitable for those planning to go either directly into industrial employment or into graduate programs in certain applied fields. The Physics Teaching major is designed specifically for those planning to teach physics at the secondary school level.

Students who are majoring in other disciplines are encouraged to consider a minor in physics, which includes a year of introductory physics plus eight credit hours of additional physics courses. These electives may be chosen to emphasize basic theory, experimental techniques, or applied subfields such as optics and astrophysics.

Physics Major

Bachelor's Degree (BS)

Program Prerequisite: Not required.

Minor: No minor is required. However, a math minor is automatically satisfied by the major requirements.

Grade requirements: An overall GPA of 2.00 is required. Also refer to the general grade requirements for graduation on page 38.

Credit hour requirements: A total of 120 semester credit hours is required for graduation; 75 to 82 of these (depending on the option chosen) are required within the Physics major. Forty upper-division credit hours are required (courses numbered 3000 and above); 30 to 34 of these (depending on the option chosen) are required within the Physics major.

Advisement

All Physics majors are strongly encouraged to meet with the chair at least annually for course and program advisement. Call 801-626-6163 for more information or to schedule an appointment. Note that because most courses have prerequisites and some advanced courses are offered only in alternate years, careful planning is essential.

Admissions Requirements

Declare your program of study (see page 18). There are no special admission or application requirements for the Physics major.

General Education

Refer to pages 38-43 for Bachelor of Science requirements. The following courses required for the Physics major will satisfy general education requirements: PHYS PS2210 and MATH 1210.

Physics Major Course Requirements for BS Degree

Physics Courses Required (23 credit hours)

PHYS PS2210/2220	Physics for Scientists & Engineers (10)
PHYS 2300	Scientific Computing for Physical Systems (3)
PHYS 2710	Introductory Modern Physics (3)
PHYS 3500	Analytical Mechanics (3)
PHYS 3510	Electromagnetic Theory (3)
PHYS 4990	Seminar in Physics (1)

Physics Electives (3 credit hours)

Select a minimum of three additional credit hours from Physics courses numbered 3000 and above. Courses in closely related disciplines may also satisfy this requirement when appropriate to the option chosen (see below). In all cases, elective courses must be approved by the department chair.

Support Courses Required (22 credit hours)

MATH 1200	Mathematics Computer Laboratory (1)
MATH 1210	Calculus I (4)
MATH 1220	Calculus II (4)
MATH 2210	Calculus III (4)
MATH 2270	Elementary Linear Algebra (3)
MATH 2280	Ordinary Differential Equations (3)
MATH 3710	Boundary Value Problems (3)

Physics Majors must also satisfy the requirements of at least one of the following four options.

1. Traditional option. By including all of the core courses in theoretical physics, this option provides a strong foundation for graduate study in physics.

Additional Physics Courses Required (17 or 18 credit hours)

PHYS 3180	Thermal Physics (3)
PHYS 3190 or 3410	Applied Optics or Electronics for Scientists (3 or 4)
PHYS 3540	Mechanical and Electromagnetic Waves (3)
PHYS 3710	Nuclear and Particle Physics (3)
PHYS 4400	Advanced Physics Laboratory (2)
PHYS 4610	Quantum Mechanics (3)

Additional Support Courses Required (10 credit hours)

CHEM PS1210/1220 Principles of Chemistry (10)

2. Physics of Materials option. This option is intended for students who have an interest in the properties of materials and their study using advanced instrumentation.

Additional Physics Courses Required (18 credit hours)

PHYS 3180	Thermal Physics (3)
PHYS 3410	Electronics for Scientists (4)
PHYS 3540	Mechanical and Electromagnetic Waves (3)
PHYS 4200	Physics of Materials (3)
PHYS 4410	Materials Characterization Laboratory (2)
PHYS 4610	Quantum Mechanics (3)

Additional Support Courses Required (10 credit hours)

CHEM PS1210/1220 Principles of Chemistry (10)

3. Astrophysics option. Supplementing a traditional physics program with several astronomy and astrophysics courses, this option is intended for students with a special interest in astronomy, including those intending to pursue graduate study in astrophysics.

Additional Physics Courses Required (23 or 24 credit hours)

ASTR 2040	Principles of Observational Astronomy (3)
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ASTR 3160	Stellar and Planetary Astrophysics (3)
ASTR 3170	Galaxies and Cosmology (3)
PHYS 3180	Thermal Physics (3)
PHYS 3190 or 3410	Applied Optics or Electronics for Scientists (3 or 4)
PHYS 3540	Mechanical and Electromagnetic Waves (3)
PHYS 4400	Advanced Physics Laboratory (2)
PHYS 4610	Quantum Mechanics (3)

Additional Support Courses Required (9 or 10 credit hours)

CHEM PS1210 Principles of Chemistry (5)

Select one of the following:

CHEM 1220 Principles of Chemistry (5)

MICR LS2054 Principles of Microbiology (4)

GEO PS1110 & 1115 Physical Geology (3) and Physical Geology Lab (1)

4. Computational Physics option. This option is intended for students with a special interest in computational techniques applied to the physical world.

Additional Physics Courses Required (15 credit hours)

PHYS 3300 Advanced Computational Physics (3)

PHYS 3410 Electronics for Scientists (4)

PHYS 4400 Advanced Physics Laboratory (2)

Select two of the following:

PHYS 3180 Thermal Physics (3)

PHYS 3540 Mechanical and Electromagnetic Waves (3)

PHYS 4610 Quantum Mechanics (3)

Additional Support Courses Required (14 credit hours)

MATH 4610/4620 Numerical Analysis (6)

Select two of the following:

CS 1410 Object-Oriented Programming (4)

CS 2420 Introduction to Data Structures and Algorithms (4)

CS 2450 Software Engineering I (4)

CS 2650 Computer Architecture/Organization (4)