

# DEPARTMENT OF PHYSICS

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**Acting Chair:** Joel W. Walker (jwalker@shsu.edu) (936) 294-4803

**Website:** Department of Physics (<http://www.shsu.edu/academics/physics>)

Physics is the study of how nature behaves. It is concerned with the basic principles of the universe and is one of the foundations on which other physical sciences are based. The beauty of physics is exhibited by the simplicity of its fundamental theories and in the way a small number of basic concepts, equations and assumptions can expand the students' understanding of the world.

## Mission

The mission of the Department of Physics is to promulgate the ability to critically think about nature through teaching and to develop the inquisitiveness to seek additional knowledge by research. In conducting this mission, the Department of Physics will provide capable scientists that can make positive contributions to our society. In order to accomplish this mission, the Department of Physics will take the following steps:

- Improve success in learning and research among all students in the department.
- Develop additional methods to plan and assess the program in the department.
- Recruit and retain qualified, motivated students.
- Promote diversity in the faculty and students.
- Collaborate with other institutions and departments to enhance education opportunities.
- Develop and implement additional educational services to off-campus audiences.
- Provide assistance to teachers in the schools preparing the future students for the institution.

## Academic Programs

Physics students may pursue a Bachelor of Science degree in Physics or a dual degree consisting of a Bachelor of Science in Physics from Sam Houston State University and a Bachelor's degree in a chosen engineering field at a university with an accredited degree program. Students also may enroll in a two-year pre-engineering program. The Bachelor of Science degree in Physical Science with Secondary Certification is available to students seeking careers in secondary education.

## Career Opportunities

Graduates with a Bachelor of Science degree either pursue further education at the graduate level or enter the workforce. Approximately one-half of the graduates pursue graduate study seeking either the Master of Science or Ph.D. degree. The remainder primarily enter the engineering profession but may also enter the fields of computer science and education.

## Program Specific Requirements

Physics students will learn the simplicity of nature and the unifying aspects of the laws of physics. This is accomplished by recognizing physical problems, developing a hypothesis and predicting the consequences of it, performing experiments to test the predictions, and formulating the results into a theory. The skills of inquiry, observation, and experimentation are used in all scientific careers including engineering, business, teaching, and administration. The Physics Department has basic research laboratories in selected fields and provides opportunities for advanced students to be involved in research projects. The University operates computer laboratories containing desktop computers, and work stations at several locations on campus.

## Curriculum

### Required Courses For Major

The Bachelor of Science degree requires at least 38 hours in Physics as follows:

Code	Title	Hours
<b>Course Requirements</b>		
PHYS 1401	Physics Boot Camp	4
PHYS 1411	Introduction To Physics I	4
PHYS 1422	Introduction To Physics II	4
PHYS 3370 & PHYS 4110	Intro To Theoretical Physics and Adv Undergrad Laboratory I	4
PHYS 3391 & PHYS 3111	Modern Physics I and Modern Physics Laboratory I	4
PHYS 4366	Intro Quantum Mechanics	3
PHYS 4368	Electricity And Magnetism	3

PHYS 4370	Classical Mechanics	3
PHYS 4371	Thermodynamics & Statistical Mech	3
PHYS 4395	Undergraduate Research	3
Select 1 or more advanced electives:		3-12
PHYS 3395 & PHYS 3115	Electronics & Circuit Analysis and Electronic & Circuit Anlys Lab	
PHYS 4333 & PHYS 4113	Light And Optics and Light And Optics	
PHYS 4367	Intro To Solid State Physics	
PHYS 4396	Selected Topics In Physics	
ASTR 3303	Life in the Universe	
ASTR 3383	Cosmic Catastrophes	
Total Hours		38-47

All Physics majors meet the requirements for a minor in mathematics.

- Bachelor of Science, Major in Physics
- Bachelor of Science, Major in Physics/Engineering Dual Degree
- Bachelor of Science, Major in Composite Science-Physics Concentration
- Pre-Engineering
- Minor in Physics

## Student Organizations

Society of Physics - The Society of Physics is a nationally recognized organization. The society sponsors field trips, campus visits by potential students, and attendance at professional meetings.

## Scholarships

The Physics Department awards scholarships on a competitive basis. Students with GPA of 3.0 or higher should inquire about the Burroughs Scholarship (awards average \$3,000 to \$4,000 per semester) to the department chair (936) 294-1601. Other general scholarships are available from the University. Information on University scholarships may be obtained at Office of Academic Scholarships (<http://www.shsu.edu/dept/financial-aid/scholarships>) or by telephone (936) 294-1672. Prospective students should contact the chair of the Physics Department, Box 2267, Huntsville, Texas 77341 or the website.

### ASTR 3303. Life in the Universe. 3 Hours.

In this course, students explore the evolution of life on Earth from an astronomical perspective and investigate the likelihood that this could happen elsewhere in the universe. This course also explores the possibility of communicating with intelligent species elsewhere in our galaxy and how humanity could best go about doing so. This course is typically taught every other year.

**Prerequisite:** PHYS 1403 and PHYS 1404.

### ASTR 3383. Cosmic Catastrophes. 3 Hours.

In this course, students build on knowledge of basic astronomical concepts discussed in previous coursework. Topics will include supernovae, neutron stars, black holes, gamma-ray bursts, worm holes, extra dimensions, and determination of the origin, state, and fate of the universe. This course is typically taught every other year.

**Prerequisite:** PHYS 1403 and PHYS 1404.

### PHYS 1101. General Physics Laboratory I. 1 Hour.

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**Prerequisite:** MATH 1410 or MATH 1316 or MATH 1420.

### PHYS 1102. General Physics Laboratory II. 1 Hour.

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### PHYS 1105. Class Phy & Thermodynamics Lab. 1 Hour.

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### PHYS 1301. General Phy-Mechanics & Heat. 3 Hours.

A modern treatment is made of the laws and principles of mechanics and heat. Derivations are carefully done using a non-calculus approach and considerable problem work is required. The laboratory work consists of quantitative experiments.

**Prerequisite:** MATH 1410 or MATH 1316 or MATH 1420 with a grade of C or better.

**PHYS 1302. Gen Phy-Snd,Lght, Elec, & Mag. 3 Hours.**

The course is a continuation of PHYS 1301, covering the subjects of sound, light, electricity and magnetism. The same emphasis is placed on derivations and problem solving as in PHYS 1301. The laboratory work consists of quantitative experiments.

**Prerequisite:** PHYS 1301 and MATH 1316 or MATH 1410 or MATH 1420.

**PHYS 1305. Classical Physics & Thermodynamic. 3 Hours.**

This is an elementary course covering the fundamentals of motion, forces and heat.

**PHYS 1401. Physics Boot Camp. 4 Hours.**

This course reviews the essential survival-level skills of problem analysis required for the first two years of the pre-engineering and physics curricula. It provides familiarity with the core problem-solving tools required for the first two years of work in these majors. A weekly problem recitation session is integrated.

**Prerequisite:** Departmental approval.

**PHYS 1403. Stars & Galaxies. 4 Hours.**

The study of the universe beyond the solar system. Topics include the nature of stars, stellar evolution, galaxies, quasars, cosmology, the universe as a whole, and theories about the origin and fate of the universe. Along the way, students will be introduced to tools astronomers use to determine such properties as temperatures, compositions, motions, masses, and evolution of astronomical objects.

**PHYS 1404. Solar System Astronomy. 4 Hours.**

The study of the solar system as well as other planetary systems. Topics include the nature of science, apparent motions in the sky, the historical development of the laws governing the solar system, the structure and membership of solar system objects, the formation of the solar system, and extrasolar planets and our understanding of other solar systems.

**PHYS 1411. Introduction To Physics I. 4 Hours.**

A thorough introduction to the more general topics in mechanics. Considerable attention is given to the solution of problems with the emphasis placed on fundamental concepts. A laboratory/problem session is an integral part of the course. Prerequisites MATH 1420 with a C or better.

**PHYS 1422. Introduction To Physics II. 4 Hours.**

An introduction to the general topics of electricity and magnetism, and basic electrical circuits. The emphasis continues to be on problem solving with the laboratory/problem session an integral part of the course.

**Prerequisite:** PHYS 1411 and MATH 1430 with a C or better.

**PHYS 2426. Heat, Waves & Modern Physics. 4 Hours.**

An introduction to topics in heat and wave motion including sound and light. The quantitative description of phenomena is emphasized. The laboratory continues as an integral part of the course.

**Prerequisite:** PHYS 1411 and MATH 1420.

**PHYS 3111. Modern Physics Laboratory I. 1 Hour.**

Modern Physics Lab.

**Prerequisite:** Grade of C or better in PHYS 1422.

**PHYS 3115. Electronic & Circuit Anlys Lab. 1 Hour.**

Prerequisites: Minimum grade of C in PHYS 1422.

**PHYS 3117. Astronomy Laboratory. 1 Hour.**

1 Credit.

**PHYS 3360. Statics And Dynamics. 3 Hours.**

Study of equilibrium, kinematics and dynamics of particles and rigid bodies using concepts of force, mass, and energy, and momentum. Vectors, calculus and differential equations are used.

**Prerequisite:** PHYS 1411 and MATH 2440.

**PHYS 3370. Intro To Theoretical Physics. 3 Hours.**

This course covers the relationship of theoretical physics and mathematics. It will help the students apply mathematics to problems in physics with emphasis on the theoretical aspects of classical mechanics, electromagnetism, wave mechanics, and computational physics.

**Prerequisite:** PHYS 1422 and MATH 2440 with a grade of C or better.

**PHYS 3391. Modern Physics I. 3 Hours.**

Relativity is introduced, quantum theory of light, Compton effect, photoelectric effect, Bohr atom, particles as waves, quantum mechanics in one dimension, tunneling, and atomic structure are covered. PHYS 3111 must be taken concurrently.

**Prerequisite:** Minimum grade of C in MATH 2440 and PHYS 1422.

**PHYS 3395. Electronics & Circuit Analysis. 3 Hours.**

Active circuit analysis, analog and digital integrated circuits, selected discrete components, and application to certain digital and analog systems are studied. PHY 315 must be taken concurrently.

**Prerequisite:** Grade of C or better in PHYS 1422.

**PHYS 3397. Astronomy. 3 Hours.**

A study is made of the solar system, sun, stars, and stellar systems, their motions, structure, energy sources and evolution, star clusters, interstellar matter, galaxies, and cosmology.

**Prerequisite:** PHYS 3117 must be taken concurrently.

**PHYS 3398. Astronomy-Honors. 3 Hours.****PHYS 4110. Adv Undergrad Laboratory I. 1 Hour.**

This laboratory course provides additional, in-depth laboratory experience for physics majors and minors and transfer students. It will emphasize measurement and data handling.

**PHYS 4113. Light And Optics. 1 Hour.**

Credit 1.

**PHYS 4331. Physics For Forensic Sciences. 3 Hours.**

Forensic science makes use of a number of physical techniques. This course is designed to provide a student with an understanding of the physics used in forensic science that enhances the standard introductory physics course. Topics covered include interior and exterior ballistics, optics, stress and strain, elementary fluid mechanics.

**PHYS 4333. Light And Optics. 3 Hours.**

The wave theory of light is emphasized. The phenomena of interference, diffraction and polarization are treated both theoretically and in selected laboratory experiments. The theory and applications of lasers are discussed and investigated in the laboratory.

**Prerequisite:** PHYS 1422 with a C or better.

**PHYS 4366. Intro Quantum Mechanics. 3 Hours.**

This course includes introductory quantum mechanics, application of quantum theory to the harmonic oscillator, potential barriers, the hydrogen atom, theory of atomic spectra, the free electron, and elementary band theory of solids.

**Prerequisite:** PHYS 3391, MATH 3376 and MATH 3391 with a grade of C or better.

**PHYS 4367. Intro To Solid State Physics. 3 Hours.**

This course introduces the concepts of crystal structure, crystal diffraction, reciprocal lattices, crystal binding, phonons, free electron Fermi gas, semiconductors, energy bands, Fermi surfaces, point defects, and optical properties of crystals.

**Prerequisite:** Minimum grade of C in PHYS 3391.

**PHYS 4368. Electricity And Magnetism. 3 Hours.**

Properties of dielectrics and magnetic materials, electromagnetic fields, and Maxwell's equations are studied.

**Prerequisite:** Minimum grade of C in MATH 3376 and PHYS 1422.

**PHYS 4370. Classical Mechanics. 3 Hours.**

The dynamics of rigid bodies, vibrating systems and normal coordinates, and other selected topics of advanced mechanics are stressed. Lagrangian and Hamiltonian concepts are introduced.

**Prerequisite:** MATH 3376.

**PHYS 4371. Thermodynamics & Statistical Mech. 3 Hours.**

Basic concepts of classical thermodynamics, including the first and second laws, properties of gases, entropy, thermodynamic functions, and introductory statistical mechanics are studied.

**Prerequisite:** PHYS 3391 and MATH 3376.

**PHYS 4395. Undergraduate Research. 3 Hours.**

This course consists of special projects or topics in experimental or theoretical physics for individual physics students. Each student pursues an approved project of interest to him, or he may participate in one of the organized research programs conducted by the physics faculty. The projects are supervised by the physics faculty, but each student is expected to demonstrate individual initiative in planning and conducting the research program or topic. The course may be repeated for an additional three semester hours credit with consent of Department Chair. This course should be taken in addition to hours required for physics major or minor and may be taken for Academic Distinction Credit. See Academic Distinction Program in this catalog.

**Prerequisite:** Consent of Department Chair.

**PHYS 4396. Selected Topics In Physics. 3 Hours.**

May be repeated for additional credit.

**Prerequisite:** Consent of the instructor.

**PHYS 4398. Senior Thesis. 3 Hours.**

This is a directed elective for senior students majoring in physics seeking additional experience in a sophisticated research project. This research will be conducted under the supervision of a member of the physics faculty and the results will be presented in the form of a thesis.

Chair: **Joel W Walker**

**James Blackman Dent, PHD** (jxd087@shsu.edu), *Assistant Professor of Physics, Department of Physics, PHD, Texas A&M University; BS, Univ of Missouri-Rolla*

**Hui Fang, PHD** (hfang@shsu.edu), *Associate Professor of Physics, Department of Physics*, PHD, Univ of Houston-Main; ME, Univ of Houston-Main; MS, Zhejiang University; BS, Zhejiang University

**Barry Friedman, PHD** (phy\_baf@shsu.edu), *Professor of Physics, Department of Physics*, PHD, Univ of Illinois-Urbana; MS, Univ of Illinois-Urbana; BA, Rice University

**Carol Renee James, PHD** (phy\_crj@shsu.edu), *Professor of Physics, Department of Physics*, PHD, Univ of Texas At Austin; MA, Univ of Texas At Austin; BA, Rice University

**Gan Liang, PHD** (phy\_gnl@shsu.edu), *Professor of Physics, Department of Physics*, PHD, Rutgers University; BS, Beijing University

**Charles R. Meitzler, PHD** (phy\_crm@shsu.edu), *Associate Professor of Physics, Department of Physics*, PHD, Rutgers University; BS, Penn State Un-Univ Park

**Scott T Miller, PHD** (stm009@shsu.edu), *Associate Professor of Physics, Department of Physics*, PHD, Univ of Maryland-College Park; MS, Univ of Maryland-College Park; BA, Rutgers University; BS, Rutgers University

**William Madsen Shepherd, PHD** (shepherd@shsu.edu), *Assistant Professor of Physics, Department of Physics*, PHD, Univ of Calif-Irvine; MS, Northwestern University; MS, Northwestern University; BA, Northwestern University; BA, Northwestern University; BA, Northwestern University

**Joel W Walker, PHD** (jwalker@shsu.edu), *Associate Professor and Chair of Physics, Department of Physics*, PHD, Texas A&M University; PHD, Texas A&M University; BS, Harding University; BS, Harding University

## Interim Faculty

**Binyang Hou, PHD**, *Visiting Assistant Professor of Physics, Department of Physics*, PHD, Univ of Illinois-Chicago; MS, Univ of Illinois-Chicago; BS, Univ of Sci & Tech of China

**Alexander Mikishev, PHD**, *Visiting Assistant Professor of Physics, Department of Physics*, PHD, Perm State University; MS, Perm State University; BS, Perm State University