School of Natural Sciences and Mathematics

Physics (B.A., B.S.)

The science of physics seeks understanding of the behavior of matter and energy at the most general and fundamental level. The physicist is trained to explore the physical universe in which people live and seeks interpretations of the natural phenomena found there. While much is known about the physical universe, many phenomena still remain to be investigated, understood, and exploited to the ultimate benefit of humankind. This is the challenge that a modern physicist faces.

Faculty

Cecil and Ida Green Chair in Physics: Roderick A. Heelis
Distinguished Chair in Physics: Myron B. Salamon
Green Distinguished Chair in Academic Leadership: B. Hobson Wildenthal
Associate Professors: Yuri Gartstein, Mustapha Ishak-Boushaki, Lindsay King, David Lary
Assistant Professors: Anton Malko, Jason Slinker
Senior Lecturers: Paul MacAlevey, Beatrice Rasmussen
Affiliated Faculty: Cyrus D. Cantrell (Engineering), John Ferraris (Chemistry), Wenchuang Hu (Engineering), Stephen Levene (Biology), Dean Sherry (Chemistry), Mary Urquhart (Science/Math Education), Duck-Joo Yang (Chemistry)

The Degrees

The student majoring in Physics must meet the general university requirements for admission and for the specific degree the student is seeking. The Physics Program offers both the Bachelor of Arts and the Bachelor of Science degrees.

Bachelor of Science

The Bachelor of Science is intended for students interested in a professional career in physics or closely related fields. It provides an excellent background for graduate programs in physics, biophysics, geophysics, engineering, medicine and other health related degree programs.

Bachelor of Arts

The Bachelor of Arts program provides an opportunity for a strong base in physics for students wishing to pursue graduate studies (non-physics) in, for example, business administration, economics, finance, oceanography, and patent or high technology law. Additionally, students seeking certification as high school teachers with physics as a major specialization and those seeking employment in industry, government service, and computer technology have the opportunity to obtain the necessary physics background through the B.A. program. The lower-division course requirements for the B.A. degree are the same as those for the B.S. degree. At the upper-division level, 15 hours of advanced physics courses are replaced with 15 hours of science electives.
UTeach Option

The UTeach option may be added to the BA degree in Physics. UTeach Dallas Option degree plans are streamlined to allow students to complete both a rigorous Bachelor of Science or Bachelor of Arts degree and all course work for middle or high school teacher certification in four years. Teaching Option degrees require deep content knowledge combined with courses grounded in the latest research on math and science education. While most graduates go on to classroom teaching, UTeach alums are also prepared to enter graduate school and to work in discipline related industry.

Graduate Studies Track

The recommended course of study toward a Bachelor of Science degree for those students who intend to pursue graduate studies in Physics begins with a two-semester Honors sequence of fundamentals of physics that gives the student a more extensive foundation in basic physics. The remainder of the program is the same as the regular B.S. program. A total of 122 credit hours are required.

Algebra Based Physics

An algebra based general physics course (PHYS 1301, 1302) with lab (PHYS 2125, 2126) is offered for students interested in the health sciences and those curious about the physical world in which we live. It stresses understanding the workings of nature and the physical processes and phenomena occurring therein.

Minor in Physics (20 hours)

A minor is offered that consists of PHYS 2325/2125 and 2326/2126, 3411, and three other upper-division physics courses.

Fast Track Baccalaureate/Master's Degrees

For students interested in pursuing graduate studies in physics, the Physics Department offers an accelerated B.S. / M.S. Fast Track that involves taking graduate courses in lieu of several advanced undergraduate courses. Acceptance into the Fast Track is based on the student's attaining a GPA of at least 3.000 on a minimum of 30 hours of upper-division courses that include PHYS 3411, 3312, 3330, 3416 and 4311. Eligible students may take up to 15 credit hours of selected graduate courses that may be used to complete the baccalaureate degree and also satisfy requirements for the master's degree. These credits will partially satisfy the M.S. degree requirements when the student completes the B.S. degree. Interested students should contact their advisor during their junior year to apply to the Fast Track program.

Bachelor of Arts in Physics

Degree Requirements (121 hours)

I. Core Curriculum Requirements\(^1\): 42 hours

Communication (6 hours)

3 hours Communication (RHET 1302)
3 hours Communication Elective (NATS 4310, PHYS 4390 or PHYS 4399)

Social and Behavioral Sciences (15 hours)
6 hours Government (GOVT 2301 and GOVT 2302)
6 hours American History
3 hours Social and Behavioral Sciences Elective

Humanities and Fine Arts (6 hours)
3 hours Fine Arts (ARTS 1301)
3 hours Humanities (HUMA 1301)

Mathematics and Quantitative Reasoning (6 hours)
6 hours Calculus (MATH 2413 or MATH 2417 and MATH 2414 or MATH 2419) \(^2\) \(^3\)

Science (9 hours)
8 hours Chemistry (CHEM 1311/1111, CHEM 1312/1112) \(^3\)
1 hour Physics (PHYS 2125) \(^3\)

II. Major Requirements: 67 hours

Major Preparatory Courses (25 hours)
MATH 2413 Differential Calculus
or MATH 2417 Calculus I
MATH 2414 Integral Calculus
or MATH 2419 Calculus II \(^2\)
MATH 2415 Calculus of Several Variables
or MATH 2451 Multivariable Calculus with Applications
MATH 2418 Linear Algebra
MATH 2420 Differential Equations with Applications \(^4\)
PHYS 1100 The Fun of Physics
PHYS 2303 Contemporary Physics \(^4\)
PHYS 2325/2125 \(^5\) Mechanics with Laboratory \(^4\)
or PHYS 2421/2125 Honors Physics I - Mechanics and Heat with Laboratory \(^4\)
PHYS 2326/2126 Electromagnetism and Waves with Laboratory \(^4\)
or PHYS 2422/2126 Honors Physics II - Electromagnetism and Waves with Laboratory \(^4\)
Major Core Courses (27 hours)

PHYS 3125 Electronics Laboratory
PHYS 3312 Classical Mechanics
PHYS 3325 Electronics
PHYS 3330 Numerical Methods in Physics and Computational Techniques
PHYS 3411 Theoretical Physics
PHYS 3416 Electricity and Magnetism
PHYS 4311 Thermodynamics and Statistical Mechanics
PHYS 4373 Physical Measurements Laboratory
PHYS XXXX Physics Elective

Major Related Courses (15 hours)

15 hours of upper division Science Electives

Advanced Writing

PHYS 4390 Senior Research and Advanced Writing
   or PHYS 4399 Senior Honors in Physics
   or NATS 4310 Advanced Writing in the Natural Sciences and Mathematics
   or Summer Research Project
   or COOP program with written final report

III. Elective Requirements: 12 hours

Advanced Electives (6 hours)

All students are required to take at least six hours of advanced electives outside their major field of study. These must be either upper-division classes or lower-division classes that have prerequisites.

Free Electives (6 hours)

Both lower- and upper-division courses may count as electives, but the student must complete at least 51 hours of upper-division credit to qualify for graduation.

Physics Electives

PHYS 3324 Scientific Computing
PHYS 3317 Physics of the Human Body
PHYS 3380 Astronomy
PHYS 4301 Quantum Mechanics I
PHYS 4302 Quantum Mechanics II
PHYS 4352 Concepts of Modern Physics
PHYS 4371 Solid State Physics
PHYS 4381 Space Science
PHYS 4383 Plasma Physics
PHYS 4395 Cosmology
PHYS 4386 Elementary Particle Physics
PHYS 4V07 Senior Projects Laboratory
PHYS 4V10 Special Topics in Physics

Other Courses
PHYS 1101 College Physics Laboratory I
PHYS 1102 College Physics Laboratory II
PHYS 1301 College Physics I
PHYS 1302 College Physics II

Bachelor of Science in Physics

Degree Requirements (121 hours)

I. Core Curriculum Requirements:\ 42 hours

Communication (6 hours)
3 hours Communication (RHET 1302)
3 hours Communication Elective (NATS 4310, PHYS 4390 or PHYS 4399)

Social and Behavioral Sciences (15 hours)
6 hours Government (GOVT 2301 and GOVT 2302)
6 hours American History
3 hours Social and Behavioral Sciences Elective

Humanities and Fine Arts (6 hours)
3 hours Fine Arts (ARTS 1301)
3 hours Humanities (HUMA 1301)

Mathematics and Quantitative Reasoning (6 hours)
6 hours Calculus (MATH 2413 or MATH 2417 and MATH 2414 or MATH 2419)², ³

Science (9 hours)

8 hours Chemistry (CHEM 1311/1111, CHEM 1312/1112)³
1 hour Physics (PHYS 2125)³

II. Major Requirements: 67 hours

Major Preparatory Courses (25 hours)

- MATH 2413 Differential Calculus
  - or MATH 2417 Calculus I
- MATH 2414 Integral Calculus
  - or MATH 2419 Calculus II
- MATH 2415 Calculus of Severable Variables
  - or MATH 2451 Multivariable Calculus with Applications
- MATH 2418 Linear Algebra
- MATH 2420 Differential Equations with Applications⁴
- PHYS 1100 The Fun of Physics
- PHYS 2303 Contemporary Physics⁴
- PHYS 2325/2125⁵ Mechanics with Laboratory⁴
  - or PHYS 2421/2125 Honors Physics I - Mechanics with Laboratory⁴
- PHYS 2326/2126 Electromagnetism and Waves with Laboratory⁴
  - or PHYS 2422/2126 Honors Physics II - Electromagnetism and Waves with Laboratory⁴

Major Core Courses (24 hours)

- PHYS 3125 Electronics Laboratory
- PHYS 3312 Classical Mechanics
- PHYS 3325 Electronics
- PHYS 3330 Numerical Methods in Physics and Computational Techniques
- PHYS 3411 Theoretical Physics
- PHYS 3416 Electricity and Magnetism
- PHYS 4311 Thermodynamics and Statistical Mechanics
- PHYS 4373 Physical Measurements Laboratory

Major Related Courses (18 hours)
PHYS 4301 Quantum Mechanics I
PHYS 4302 Quantum Mechanics II
PHYS 4328 Optics
PHYS 4352 Concepts of Modern Physics

6 hours Physics Electives

Advanced Writing (fulfills 3 hours of Core Communications requirement)

PHYS 4390 Senior Research and Advanced Writing
or PHYS 4399 Senior Honors in Physics
or NATS 4310 Advanced Writing in the Natural Sciences and Mathematics
or Summer Research Project
or COOP program with written final report

III. Elective Requirements: 12 hours

Advanced Electives (6 hours)

All students are required to take at least six hours of advanced electives outside their major field of study. These must be either upper-division classes or lower-division classes that have prerequisites.

Free Electives (6 hours)

Both lower- and upper-division courses may count as electives, but the student must complete at least 51 hours of upper-division credit to qualify for graduation.

Physics Electives

PHYS 3324 Scientific Computing
PHYS 3345 Physics of the Human Body
PHYS 3380 Astronomy
PHYS 4385 Cosmology
PHYS 4386 Elementary Particle Physics
PHYS 4371 Solid State Physics
PHYS 4381 Space Science
PHYS 4383 Plasma Physics
PHYS 4V07 Senior Projects Laboratory
PHYS 4V10 Special Topics in Physics
Other Courses

PHYS 1101 College Physics Laboratory I
PHYS 1102 College Physics Laboratory II
PHYS 1301 College Physics I
PHYS 1302 College Physics II

Bachelor of Arts in Physics with UTeach Option

Degree Requirements (124-126 hours)

I. Core Curriculum Requirements¹: 42 hours

Communication (6 hours)

3 hours Communication (RHET 1302)
3 hours Communication Elective (NATS 4390/NATS 4399)

Social and Behavioral Sciences (15 hours)

6 hours Government (GOVT 2301 and GOVT 2302)
6 hours American History
3 hours Social and Behavioral Sciences Elective

Humanities and Fine Arts (6 hours)

3 hours Fine Arts (ARTS 1301)
3 hours Humanities (HUMA 1301)

Mathematics and Quantitative Reasoning (6 hours)

6 hours Calculus (MATH 2413 and MATH 2414)³ ⁶

Science (9 hours)

8 hours Chemistry (CHEM 1311/1111, CHEM 1312/1112)³
1 hour Physics (PHYS 2125)³

II. Major Requirements: 67-69 hours

Major Preparatory Courses (25-27 hours beyond core curriculum)

MATH 2413 Differential Calculus
or MATH 2417 Calculus I

¹ These requirements are specific to the bachelor's degree in physics with the UTeach option at UT Dallas.
MATH 2414 Integral Calculus\(^6\)
or MATH 2419 Calculus II

MATH 2415 Calculus of Several Variables
or MATH 2451 Multivariable Calculus with Applications

MATH 2418 Linear Algebra\(^4\)

MATH 2420 Differential Equations with Applications\(^4\)

PHYS 1100 The Fun of Physics

PHYS 2303 Contemporary Physics\(^4\)

PHYS 2325/2125 Mechanics with Laboratory\(^4\)
or PHYS 2421/2125 Honors Physics I - Mechanics and Heat with Laboratory\(^4\)

PHYS 2326/2126 Electromagnetism and Waves with Laboratory\(^4\)
or PHYS 2422/2126 Honors Physics II - Electromagnetism and Waves with Laboratory\(^4\)

**Major Core Courses (27 hours)**

PHYS 3125 Electronics Laboratory

PHYS 3411 Theoretical Physics

PHYS 3312 Classical Mechanics

PHYS 3325 Electronics

PHYS 3330 Numerical Methods in Physics and Computational Techniques

PHYS 3416 Electricity and Magnetism

PHYS 4311 Thermodynamics and Statistical Mechanics

PHYS 4373 Physical Measurements Laboratory

PHYS Elective

**Major Related Courses (15 hours)**

15 hours of upper division Science Electives

NATS 4694/4696 UTeach Student Teaching can fulfill 6 of these hours.

**III. Elective Requirements: 15 hours**

**Advanced Electives (6 hours)**

All students are required to take at least six hours of advanced electives outside their major field of study. These must be either upper-division classes or lower-division classes that have prerequisites. UTeach courses can be used to fulfill these requirements.
UTeach Requirements (9 hours beyond core curriculum, science electives, and advanced electives)

- **NATS 1141** UTeach Step 1
- **NATS 1143** UTeach Step 2
- **NATS 3341** Knowing and Learning in Mathematics and Science
- **NATS 3343** Classroom Interactions
- **HIST 3328** History and Philosophy of Science and Medicine
- **NATS 4390/4399** Research Methods
- **NATS 4341** Project-Based Instruction
- **NATS 4694** UTeach Student Teaching, 8-12 Science and Mathematics
  - or **NATS 4696** UTeach Student Teaching, 4-8 Science and Mathematics
- **NATS 4141** UTeach Student Teaching Seminar

Both lower- and upper-division courses may count as electives, but the student must complete at least 51 hours of upper-division credit to qualify for graduation.

1. Curriculum Requirements can be fulfilled by other approved courses from accredited institutions of higher education. The courses listed in parentheses are recommended as the most efficient way to satisfy both Core Curriculum and Major Requirements at UT Dallas.
2. Two hours of Calculus are counted as Major Preparatory credit; six hours are counted in Core Curriculum. Students may choose either calculus sequence MATH 2413, 2414, and 2415 or MATH 2417, 2419 and 2451.
3. Required preparatory coursework.
4. Indicates a prerequisite class to be completed before enrolling for upper-division classes.
5. Counted in Core Curriculum
6. Two hours of Calculus are counted as Major Preparatory credit; six hours are counted in Core Curriculum.
7. NATS 4390/4399 fulfills Core Communication requirement.
8. Counts as 6 hours of Science Electives Both lower- and upper-division courses may count as electives, but the student must complete at least 51 hours of upper-division credit to qualify for graduation.

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