Physics and Astronomy

The Wiess School of Natural Sciences

Chair
F. Barry Dunning

Professors
Stephen D. Baker
Billy E. Bonner
Paul A. Cloutier
Marjorie D. Corcoran
Michael W. Deem
Ian M. Duck
Reginald J. Dufour
Arthur A. Few, Jr.
James P. Hannon
Thomas W. Hill
Huey W. Huang
Randall G. Hulet
Neal Lane
Eugene H. Levy
Edison P. Liang
Hannu E. Miettinen
Gordon S. Mutchler
Peter Nordlander
Carl Rau
Patricia H. Reiff
Jabus B. Roberts, Jr.
Richard E. Smalley
Paul M. Stevenson

Professors Emeriti
John W. Freeman
William E. Gordon, Distinguished
F. Curtis Michel
Ronald F. Stebbings
G. King Walters
Richard A. Wolf

Associate Professors
David Alexander
Anthony A. Chan
Stanley A. Dodds

Assistant Professors
Patrick M. Hartigan
Qimiao Si
Matthew G. Baring
Kedar S. Damle
Jason H. Hafner
Christopher Johns-Krull
Ching-Hwa Kiang
Thomas C. Killian
Douglas A. Natelson
Uwe Oberlack
B. Paul Padley
Han Pu
Alexander J. Rimberg
Frank R. Toffoletto

Adjunct Professors
David C. Black
James L. Burch
Franklin R. Chang-Diaz
James H. Newman
Carolyn Sumners
J. David Winningham

Adjunct Associate Professors
Hui Li
Tomasz F. Stepinski

Instructor
Gary A. Morris

Degrees Offered: B.A., B.S., M.S., Ph.D.

The Department of Physics and Astronomy offers undergraduate and graduate programs for a wide range of interests. The bachelor of arts degrees in physics and in
all physics majors must complete the following courses:

PHYS 101 or 111 Mechanics (with Lab)
PHYS 102 or 112 Electricity and Magnetism (with Lab)
PHYS 201 Waves and Optics
PHYS 202 Modern Physics
PHYS 231 Elementary Physics Laboratory II
PHYS 301 Intermediate Mechanics

math 101/102 single variable calculus i and ii
math 211 ordinary differential equations and linear algebra
math 212 multivariable calculus
(MATH 221/222 Honors Calculus III and IV may substitute for MATH 211/ MATH 212)

additional courses for the B.S. degree in physics:

PHYS 302 Intermediate Electrodynamics
PHYS 311/312 Introduction to Quantum Physics I and II
PHYS 331/332 Junior Physics Laboratory I and II
PHYS 411 Introduction to Nuclear and Particle Physics
PHYS 412 Solid-state Physics
PHYS 425 Statistical and Thermal Physics
PHYS 491/492 Undergraduate Research Seminar

(The Undergraduate Research course and seminar must be taken concurrently.)

MATH 381 Introduction to Partial Differential Equations and
MATH 382 Complex Analysis
or
CAAM 335 Matrix Analysis and
CAAM 336 Differential Equations in Science and Engineering

CHEM 121/122 General Chemistry with Laboratory
or
CHEM 151/152 Honors Chemistry with Laboratory

additional courses for the B.S. degree in physics with option in applied physics:

PHYS 302 Intermediate Electrodynamics
or ELEC 306 Electromagnetic Fields and Devices

PHYS 311 Introduction to Quantum Physics I
PHYS 312 Introduction to Quantum Physics II or ELEC 361 Electronic Materials and Quantum Devices
2 of PHYS 331/332 Junior Physics Laboratory I and II, ELEC 327 Digital Logic Design Laboratory, ELEC 342 Electronic Circuits, and ELEC 465 Physical Electronics Practicum.

PHYS 412 Solid-state Physics or Approved substitute in applied physics.

PHYS 425 Statistical and Thermal Physics

PHYS 491/492 Undergraduate Research

PHYS 493/494 Undergraduate Research Seminar

(The Undergraduate Research course and seminar must be taken concurrently.)

ELEC 242 Fundamentals of Electrical Engineering II or ELEC 243 Introduction to Electronics

ELEC 305 Introduction to Physical Electronics

MATH 381 Introduction to Partial Differential Equations or CAAM 336 Differential Equations in Science and Engineering

CHEM 121/122 General Chemistry with Laboratory or CHEM 151/152 Honors Chemistry with Laboratory

Additional courses for the B.S. degree in physics with option in biophysics:

PHYS 302 Intermediate Electrodynamics

PHYS 311/312 Introduction to Quantum Physics I and II

PHYS 425 Statistical and Thermal Physics

BIOS 201/202 Introductory Biology

BIOS 301 Biochemistry

CHEM 121/122 General Chemistry with Laboratory or CHEM 151/152 Honors Chemistry with Laboratory

CHEM 211/212 Organic Chemistry

CHEM 215 Organic Chemistry Laboratory

Additional courses for B.S. degree in physics with option in computational physics:

PHYS 302 Intermediate Electrodynamics

PHYS 311/312 Introduction to Quantum Physics I and II

PHYS 416 Computational Physics

PHYS 425 Statistical and Thermal Physics

PHYS 491/492 Undergraduate Research

PHYS 493/494 Undergraduate Research Seminar

(The Undergraduate Research course and seminar must be taken concurrently.)

MATH 381 Introduction to Partial Differential Equations and MATH 382 Complex Analysis

or CAAM 335 Matrix Analysis and CAAM 336 Differential Equations in Science and Engineering

CAAM 210 or 211 Introduction to Engineering Computation

CAAM 353 Computational Numerical Analysis

CAAM 420/421 Computational Science I and II

CHEM 121 General Chemistry with Laboratory or CHEM 151 Honors Chemistry with Laboratory

Additional courses for the B.S. degree in astrophysics:

PHYS 302 Intermediate Electrodynamics

PHYS 311 Introduction to Quantum Physics I

PHYS 425 Statistical and Thermal Physics

ASTR 230 Astronomy Laboratory

ASTR 350/360 Introduction to Astrophysics—Stars, Galaxies, and Cosmology

3 courses from:

ASTR 450 Experimental Space Science

ASTR 451 Solar and Stellar Astrophysics
ASTR 452 Galaxies and Cosmology
ASTR 470 Solar System Physics
PHYS 312 Introduction to Quantum Physics II
PHYS 480 Introduction to Plasma Physics
PHYS 491/492 Undergraduate Research
PHYS 493/494 Undergraduate Research Seminar

(The Undergraduate Research course and seminar must be taken concurrently.)
NSCI 230 Computation in Natural Science or CAAM 210 or 211 Introduction to Engineering Computation
CAAM 336 Differential Equations in Science and Engineering
CHEM 121 General Chemistry with Laboratory

Additional courses for the B.A. degree in physics:

PHYS 302 Intermediate Electrodynamics
PHYS 311 Introduction to Quantum Physics I
PHYS 331 Junior Physics Laboratory I
PHYS 425 Statistical and Thermal Physics

1 additional PHYS or ASTR course (3 credit hours) at 400 level
NSCI 230 Computation in Natural Science or CAAM 210 or 211 Introduction to Engineering Computation or 1 MATH or CAAM course (3 credit hours) at or above 300 level

Additional courses for the B.A. degree in astronomy:

PHYS 331 Junior Physics Laboratory I
or
NSCI 230 Computation in Natural Science
PHYS 425 Statistical and Thermal Physics
or
CHEM 311 Physical Chemistry
AST 100 Exploring the Cosmos

ASTR 230 Astronomy Laboratory
ASTR 350/360 Introduction to Astrophysics—Stars, Galaxies, and Cosmology
ASTR 470 Solar System Physics
1 of: ASTR 430 Teaching Astronomy Laboratory, ASTR 450 Experimental Space Science, or PHYS 443 Atmospheric Science

Additional courses for the B.S. degree in chemical physics:

CHEM 121/122 General Chemistry or
CHEM 151/152 Honors Chemistry with Laboratory
CHEM 211 Organic Chemistry
CHEM 212 Organic Chemistry
or
CHEM 360 Inorganic Chemistry
CHEM 311/312 Physical Chemistry

PHYS 302 Intermediate Electrodynamics
2 of: PHYS 311 or 312 Introduction to Quantum Physics I or II, CHEM 415 Chemical Kinetics and Dynamics, and CHEM 430 Quantum Chemistry
Requirements for Advanced Degrees

For general university requirements, see Graduate Degrees (pages 65–70). More detailed information on courses and requirements is available from the Department of Physics and Astronomy.

The master of science is a research degree, normally undertaken as the first stage of doctoral study. The M.S. requires at least 30 credit hours of approved graduate-level studies, including a thesis performed under the direction of a departmental faculty member.

To be eligible for the Ph.D. degree, graduate students must demonstrate to the department their ability to engage in advanced research. This is normally accomplished by successfully completing the work for the M.S. Students must also complete 60 credit hours of approved graduate-level study at Rice and produce a research thesis under the direction of a departmental faculty member. At least two years of graduate study are required for the Ph.D.

See ASTR and PHYS in the Courses of Instruction section.