



# PHYSICS

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## Introduction to Physics

Physics is the study of the physical universe and its contents — from the tiniest particles to distant galaxies.

Majoring in physics at UR is a great first step towards physics graduate school and a life-long career of exploring the most fundamental secrets of our universe. But physics majors can also excel in applied fields like engineering, and they learn technical skills like data analysis and problem solving that are valued by a wide range of employers. Physics majors can also go on to medical school or law school.

The physics department is active in research in a variety of areas, including astrophysics, biophysics, nuclear and particle physics, nanoscience and nanotechnology, optics, and materials science.

The UR physics department is recognized for our “large” number of physics majors by the American Institute of Physics. In fact, we graduate about 12–15 majors per year — large enough to offer a broad curriculum, but small enough to offer small classes and research opportunities for students.

## Learning Environment

The department prides itself on its small class sizes, a student-oriented learning environment, and a strong emphasis on student involvement in research.

Introductory courses, which have a maximum class size of 24 students, use a workshop approach that integrates laboratory experiments into the classroom experience. Students test their ideas about the nature of the physical world and build their physics intuition by doing “what if ...” experiments using computerized motion detection and video analysis systems.

Advanced classes and laboratories make extensive use of modern electronics equipment and computers for simulation, data collection, analysis, and presentation. Students at all levels work and study together, building a strong sense of community and camaraderie from early on in their college careers.

Physics students are strongly encouraged

to participate with physics faculty members in their research during the academic year, often starting as early as their first year. Financial support is available for students who wish to work with faculty on research in the summer.

## Facilities and Resources

The department is housed in the Gottwald Center for the Sciences. The center also is home to the biology and chemistry departments, fostering collaboration between students and faculty across the three fields. Gottwald has 22 teaching laboratories in addition to 50 student-faculty laboratories.

Physics students and faculty take advantage of the latest technology to pursue their research. Current areas of research include experimental nuclear and particle physics, biophysics, cosmology, astrophysics, material science, and nanotechnology. In-house research facilities for use by students and faculty include two biophysics/computational science laboratories, an astrophysics/telescope laboratory, a state of the art atomic force microscope laboratory for use in surface science and biophysics, and an environmental radiation detection laboratory.

In addition to in-house research facilities, students and faculty participate in nuclear physics experiments to probe the smallest forms of matter at the nearby Thomas Jefferson National Accelerator Facility in Newport News, Va., as well as at the Cyclotron Facility at Texas A&M University and other national accelerator facilities. Many Richmond students and faculty are supported by grants from the U.S. Department of Energy, the National Science Foundation, the Research Corporation, and other agencies involved with research at world-class facilities. Through this support, students travel with faculty to conduct research and participate in national and international conferences to present their work.

## Multiple Degree Options

For students who wish to pursue technical careers, advanced study in physics, or study in related fields like astronomy or engineering, UR offers a Bachelor of Science degree in physics. This option provides a strong foundation in physics and math that prepares students well for the physics GRE and eventual graduate study — though there is also plenty of room for courses in other subjects, or even for study abroad.

For students whose interests span more than one traditional discipline, UR also offers a major in interdisciplinary physics, allowing students to choose a subset of courses in physics along with courses in one of these concentrations:

- Biochemistry
- Biology
- Chemistry
- Computer Science
- Mathematics

A concentration in Engineering is also available through one of our dual degree programs, (often a “3-2 engineering program”) in which students combine initial coursework at UR with later coursework in engineering at one of our partner schools, earning either two bachelor’s degrees or bachelor’s and master’s degrees.

For students who do not plan either future study in physics or a career in a technical field, a Bachelor of Arts degree in physics is available that allows students even more freedom to pursue additional courses in the humanities, social sciences, leadership, or business.

## Recent Undergraduate Research Topics

“Pion Identification in Calculating the Neutron Detection Efficiency in the CLASIZ Detector”

“Evolution of Vibrational to Rotational Structure in Nuclei”

“The Cosmic Microwave Background and the Three-Point Function”

“Development of a Computing Cluster at the University of Richmond”

“The Use of Oscillatory Signals in the Study of Genetic Networks”  
 “A Mathematical Law for Heat-Stressed Mammalian Cells”  
 “Mapping the Alhasid Arc in the Nuclear Symmetry Triangle in SU(3) Basis”  
 “Studies of Nuclei Near E(5)”  
 “Measuring Diblock Copolymer Grain Boundary Migration”  
 “Properties of Electrospun Polyethylene Oxide”  
 “Active Galaxy Nuclei: Deriving black hole properties from gamma-ray observations of blazars”  
 “CAD Modeling of an Ultrahigh Vacuum Dewar”  
 “Polychromatic map-making from imaging telescopes with asymmetric beams”  
 “Examining the Feasibility of Low Energy Nuclear Reactions”

## Graduate School Acceptances

Boston University  
 California Institute of Technology  
 Cornell University  
 The Edward Via College of Osteopathic Medicine  
 Georgia Tech  
 Johns Hopkins University  
 Massachusetts Institute of Technology  
 Michigan State University  
 Princeton University  
 Rensselaer Polytechnic Institute  
 Rowan School of Osteopathic Medicine  
 University of California, Berkeley  
 University of California, Davis  
 University of California, Los Angeles  
 University of Chicago  
 University of Colorado, Boulder  
 University of Illinois  
 University of Kentucky  
 University of Leeds, Westshire, England  
 University of North Carolina, Chapel Hill  
 University of Notre Dame Law School  
 University of Richmond Law School  
 University of Pittsburgh  
 University of Virginia  
 Vanderbilt University  
 Yale University

## Recent Graduate Employment

Consolidated Laboratories  
 Federal Reserve System, Washington, D.C.  
 Intel  
 Merck Pharmaceuticals  
 National Aeronautics and Space Administration (NASA)  
 Naval Surface Warfare Center, DoD  
 Northrop Grumman  
 Science Applications International Corporation  
 Tyco  
 Wolfram Research

## Integrated and Inclusive Science

The Integrated and Inclusive Science program offers interdisciplinary options for students interested in the natural sciences. Opportunities for first-year students include the following:

- URISE: University of Richmond Integrated Science Experience, a comprehensive program combining early and extensive undergraduate research with an emphasis on interdisciplinary STEM education. URISE is a summer pre-first-year research experience that aims to remove barriers for under-represented students in STEM disciplines.
- Science, Math, and Research Training (SMART) combines introductory biology and chemistry with a coordinated calculus course. Future offerings of this course may apply a similar interdisciplinary approach to other disciplines in the natural sciences.

Students may also choose to complete a minor in Integrated and Inclusive Science, which emphasizes Interdisciplinary aspects of science.

## Faculty

**Emory (Ted) F. Bunn**  
 Department Chair  
 Ph.D., University of California, Berkeley  
 Area of specialty: cosmology

**Mariama Rebello de Sousa Dias**  
 Ph.D., Federal University of San Carlos, Brazil  
 Area of specialty: nanoscale physics

**Gerard P. Gilfoyle**  
 Ph.D., University of Pennsylvania  
 Areas of specialty: experimental nuclear physics, national defense policy

**Christine Carlisle Helms**  
 Ph.D., Wake Forest University  
 Areas of specialty: biophysics, nanotechnology, and hemostasis

**Ovidiu Lipan**  
 Ph.D., University of Chicago  
 Area of specialty: biological physics

**Bharathi Subramaniasiva**  
 Ph.D., Bharathiar University, India  
 Areas of specialty: nanotechnology and sustainable energy

**Jack Singal**  
 Ph.D., University of California, Santa Barbara  
 Area of specialty: astrophysics/large telescope development

**Matthew Trawick**  
 Ph.D., The Ohio State University  
 Area of specialty: material science



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