



GRADUATE STUDY *at*



RICE

The first Ph.D. in physics from Rice was awarded in 1920, the second doctorate earned at the university. Since then, the physics and astronomy graduate program has grown to an enrollment of about 120, with about 18 students arriving each year. Recent graduates hold positions in academic institutions, national laboratories, industrial laboratories and entrepreneurial enterprises.

With more than 40 graduate faculty, the department now offers programs for a wide range of interests. Research facilities and thesis supervision are available for Ph.D. students in astronomy, atomic, molecular and optical physics; biophysics; condensed matter and nanoscale physics; cosmology and particle astrophysics, nuclear and particle physics; and space plasma and solar physics.

#### **CURRENT RESEARCH**

The following brief summaries indicate the breadth of research activity in physics and astronomy. More detail can be found on our Web site: [www.physics.rice.edu](http://www.physics.rice.edu).

#### **ASTRONOMY**

Theoretical work is concerned with high-energy electromagnetic processes, dense and/or intensely magnetized plasmas, accretion disk phenomena, and gamma-ray bursters. Observational studies are concerned with gamma-ray bursters and pulsars and with multi-wavelength imagery and spectroscopy of astrophysical plasmas, particularly HII regions; newly formed stars, their accretion disk, and outflows; and extrasolar planetary formation and evolution.

#### **ATOMIC, MOLECULAR AND OPTICAL PHYSICS**

Rice University has an active, top-10 ranked program in experimental and theoretical atomic physics. Of particular interest are systems of ultra-cold atomic gases, both fermions and bosons, as a new platform for studying many-body and plasma physics. Current activity involves the study of Bose-Einstein condensates with tunable interactions, strongly correlated atomic and molecular systems confined to optical lattices, systems in lower dimensions, and long-range interactions created in gases of polar molecules or Rydberg atoms.

#### **BIOPHYSICS**

Experimental groups study membrane active proteins, membrane fusion, membrane electrostatics, protein folding free energy, DNA-linked gold particles, and nanobiosensors. There also is theoretical work on protein energy landscapes and free energy models of the immune system. Theoretical efforts also leverage Rice's Center for Theoretical Biophysics, a National Science Foundation Physics Frontier Center.

#### **CONDENSED MATTER PHYSICS**

Strongly correlated electron systems, non-Fermi liquid behavior, nanoscale physics and plasmonics are studied theoretically and computationally. Experimental work includes electronic and optical response of nanostructures; topology and correlations in systems of reduced dimensionality; neutron, x-ray, and photoemission spectroscopy of quantum materials; and discovery and thermodynamic properties of quantum materials.

## **GRADUATE STUDY IN PHYSICS AND ASTRONOMY**

RICE UNIVERSITY

[WWW.PHYSICS.RICE.EDU](http://WWW.PHYSICS.RICE.EDU)

FOR ADMISSION  
IN 2020



### **COSMOLOGY AND PARTICLE ASTROPHYSICS**

Some of the current theoretical questions being pursued include: How did the hot big bang begin? Why is there more matter than antimatter in our universe? What is the cosmic history of the Higgs field? What is the nature of dark matter and dark energy? Experimental work focuses on the detection of dark matter.

### **NUCLEAR AND PARTICLE PHYSICS**

Rice theorists work on perturbative and nonperturbative methods in quantum field theory. Experimental efforts include studies of hot, dense nuclear matter at the Relativistic Heavy Ion Collider as well as the CERN Large Hadron Collider (LHC); and the study of the Higgs boson as well as the search for new particles and interactions beyond the Standard Model, through the CMS experiment at the LHC.

### **SPACE PLASMA AND SOLAR PHYSICS**

A computational and theoretical group works on magnetospheric structure and dynamics, both terrestrial and planetary. There also is theoretical work on electromagnetic wave-particle interactions. Observational programs are concerned with mission planning and data analysis for earth and planetary plasma probes. There also is an integrated observational and modeling program for solar corona and solar-terrestrial interactions.

### **DEGREE REQUIREMENTS**

To be eligible for the Ph.D. degree, graduate students must demonstrate to the department their ability to engage in advanced research and their knowledge of the discipline. Each student must complete at least eight approved graduate courses, an oral Ph.D. candidacy exam based on specific topics relevant to the research subfield, write and defend a research proposal, and complete the teaching practicum. The degree is conferred upon successful public defense of a Ph.D. research thesis done under the direction of a departmental faculty member. The department does not have a written qualifying exam, nor is there a foreign language requirement. Students must complete a total of 90 credit hours of approved graduate-level study beyond the bachelor's degree, including thesis research. They also must be in residence for at least four semesters of full-time graduate study at Rice for the Ph.D.

All graduate students in the doctoral programs share nominal teaching responsibilities in the department for a total of four semesters, beginning in the second semester of residence. Assignments typically include some combination of grading and instruction in the undergraduate laboratories. The total time commitment, including preparation, is expected to be about six hours per week.

## CAMPUS VISIT

We invite you to visit Rice at any time for a firsthand look at the department and the beautiful, tree-lined campus near the heart of Houston. During your time here you will not only meet with faculty, but usually you will be hosted by current graduate students from whom you can learn more about graduate life on campus and in Houston.

Domestic students who are admitted to the doctoral program are particularly encouraged to visit and learn more about the opportunities in physics and astronomy. The department will assist with some travel expenses.

## ADMISSION AND FINANCIAL ASSISTANCE

### *Application materials*

Students must submit the following materials with their completed online application form ([www.physics.rice.edu](http://www.physics.rice.edu)):

- Transcripts from all colleges and universities attended
- Official scores from the Graduate Record Examination (GRE)
- Three letters of recommendation
- An official score from the TOEFL, for students who speak English as a second language
- A \$85 application fee
- General GRE is required.
- The GRE Physics is not required.

All materials should be sent to the address given. For full consideration, applications must be complete by January 1.

### ADMISSION FACTS

*Number of applicants in 2019: 244*

*Number of applicants accepted in 2019: 66*

*Minimum TOEFL score:* 250 on computer-based test and 90 on Internet-based test (applicants below 260 or equivalent are rarely admitted)

### Other admissions information:

*Undergraduate preparation:* Typical preparation includes advanced undergraduate courses in mechanics, electricity and magnetism, quantum mechanics, and statistical physics. Mathematics at least through partial differential equations and complex analysis and one year of advanced undergraduate laboratory.

### FINANCIAL ASSISTANCE

Students seeking the Ph.D. degrees receive Rice graduate fellowships for their first academic year. For 2019–20, this provides a stipend of \$23,700 for nine months and a scholarship to cover full tuition. At the end of the first academic year, students affiliate with a research group and are supported at a comparable level by faculty research grants, contracts or external fellowships on a 12-month basis.

### FINANCIAL FACTS

*Tuition for 2019–20:* \$48,330 (Tuition is paid for all students in the doctoral program.)

*Other fees for 2018–19:* \$612

*Stipend for 2019–20:* \$31,600 (12-month basis)





## ABOUT RICE AND HOUSTON

Rice is a leading American research university—small, private and highly selective—distinguished by a collaborative, interdisciplinary culture and a global perspective. Only a few miles from downtown Houston, it occupies an architecturally distinctive, 285-acre campus shaded by nearly 4,000 trees. State-of-the-art facilities and laboratories, internationally renowned centers and institutes and one of the country's largest endowments support an ideal learning and living environment. US News recently did a ranking of the Best Global Universities by subject area, using actual quantitative analytics information. **Rice University was ranked number 26 in the world in the discipline of physics, and ranked number 15 in the United States!**

The university attracts a diverse group of highly talented students and faculty with outstanding graduate and professional programs in the humanities, social sciences, natural sciences, engineering, architecture, music and business. With just 3,018 graduate students and 3,942 undergraduates, it offers an unusual opportunity to forge close relationships with eminent faculty scholars and researchers and the option to tailor graduate programs to specific interests.

Houston offers all the expected educational, cultural and commercial advantages of a large urban center, and more. It's home of the Texas Medical Center, the largest concentration of medical schools, hospitals and research facilities in the world, as well as several other universities. Rice has cooperative programs with the University of Houston, Baylor College of Medicine, the University of Texas Health Science Center and Texas Southern University. Houston is one of the few U.S. cities with resident companies in all four major performing arts—drama, ballet, opera and symphony. It also boasts a museum district featuring exhibits of national and international prominence. Houston is also the home of several professional sports teams, including the Houston Astros baseball team, who became the World Series Champions on 11/1/17.

As urban as it is, Houston also is a surprisingly green city. Houstonians enjoy the outdoors in more than 300 municipal parks and 120 open spaces, and many frequent the beach at Galveston Island, only a 45-minute drive away. Other short trips include Austin, the state's capital, and historic San Antonio, both of which are a little more than three hours away.

### FOR FURTHER INFORMATION CONTACT:

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**Website:** [www.physics.rice.edu](http://www.physics.rice.edu)  
**Admissions website:** <https://gradadmissions.rice.edu/apply>

### FOR ADDITIONAL INFORMATION:

Rice University homepage:  
[www.rice.edu](http://www.rice.edu)  
Rice University Office of Graduate and Postdoctoral Studies homepage:  
[graduate.rice.edu](http://graduate.rice.edu)  
Graduate Student Association homepage:  
[gsa.rice.edu](http://gsa.rice.edu)  
City of Houston homepage:  
[www.houstontx.gov](http://www.houstontx.gov)  
Houston information from the *Houston Chronicle*:  
[www.chron.com](http://www.chron.com)  
Houston information from the Greater Houston Partnership:  
[www.houston.org](http://www.houston.org)  
Houston information from Citysearch:  
<http://houston.citysearch.com>  
GradSchoolShopper webpage for Rice University:  
<https://www.gradschoolshopper.com/gradschool/sclisting.jsp?rec=363>



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