

# NANOSCALE PHYSICS

## THE WIESS SCHOOL OF NATURAL SCIENCES

### **DIRECTOR**

F Barry Dunning

### **PROFESSORS**

Andrew R. Barron

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### **ASSOCIATE PROFESSOR**

Vicki L. Colvin

### **ASSISTANT PROFESSORS**

Jason H. Hafner

Thomas C. Killian

Douglas A. Natelson

Frank R. Toffoletto

### **FACULTY FELLOW**

Kristen M. Kulinowski

### **DEGREES OFFERED: MS**

Rice University introduced a professional master's degree in Nanoscale Physics in fall 2002. This program combines a strong component in quantum theory, which governs the behavior of systems at the nanoscale, with the study of practical nano- and mesoscale devices. The program provides the student with the knowledge required to successfully navigate the emerging field of nanotechnology. New courses cover cutting-edge areas such as quantum behavior of nanostructures, quantum nanotechnology, nanoscale imaging, and the fabrication of nanostructures. In addition, a year-long course in methods of experimental physics ensures that students obtain the advanced practical skills valuable to industry.

The Nanoscale Physics degree is one of three tracks in the new Professional Master's Program at Rice housed in the Wiess School of Natural Sciences. These master's degrees are designed for students seeking to gain further scientific core expertise coupled with enhanced management and communication skills. These degrees instill a level of scholastic proficiency that exceeds that of the bachelor's level and creates the cross-functional aptitudes needed in modern industry. This will allow students to move more easily into management careers in consulting or research and development, design, and marketing of new science-based products.

### **DEGREE REQUIREMENTS FOR THE MS IN NANOSCALE PHYSICS**

In addition to the core science courses, students are required to complete a three- to six-month internship and take a set of cohort courses focusing on business and communication. At the conclusion of the internship, students must present a summary of the internship project in both oral and written form as part of the Professional Master's Seminar.

Part-time students who already work in their area of study may fulfill the internship requirement by working on an approved project with their current employer. Certain course requirements may be waived based upon prior graduate coursework or industrial experience. For general university requirements for graduate study, see pages 64–70, and see also Professional Degrees, page 58.

### **ADMISSION**

Admission to graduate study in nanoscale physics is open to qualified students holding a bachelor's degree in physics, electrical engineering, or a related field that includes intermediate level work in mathematics, electrodynamics, and quantum physics. Department faculty evaluate the previous academic record and credentials of each applicant individually.

**Science core courses:**

PHYS 533 *Nanostructures and Nanotechnology I* (F)  
 PHYS 539 *Characterization and Fabrication at the Nanoscale* (F)  
 PHYS 537 *Methods of Experimental Physics I* (F)  
 PHYS 534 *Nanostructures and Nanotechnology II* (S)  
 PHYS 538 *Methods of Experimental Physics II* (S)  
 PHYS 416 *Computational Physics* (S)

**Cohort courses:**

MGMT 750 *Management in Science and Engineering* (F)  
 NSCI 501 *Professional Master's Seminar* (F, S)  
 [required for two semesters]  
 NSCI 512 *Professional Master's Project* (F, S)  
**Plus a single course from the following:**  
 ENST 312 *Environmental Battles in the 21st Century: Houston as Microcosm* (S)  
 PHIL 307 *Social and Political Philosophy* (F)  
 POLI 338 *Policy Analysis* (S)  
 POLI 537 *Public Policy and Bureaucracy* (F)  
 PHIL 316 *Philosophy of Law* (F)

**INTERNSHIP**

An internship under the guidance of a host company, government agency, or national laboratory. A summary of the internship project is required in both oral and written form as part of the Professional Master's Project.

**ELECTIVE COURSES**

Note: Each of these electives is not offered every year, and some courses may have prerequisites or require instructor permission.

Students will choose four elective courses, two of which must be science or engineering 500 level or above. Recommended courses include, but are not limited to, the following:

CAAM 378 <i>Introduction to Operations Research</i> (F)	ELEC 685 <i>Fundamentals of Medical Imaging</i> (F)
CENG 630 <i>Chemical Engineering of Nanostructured Materials</i> (S)	ENGI 303 <i>Engineering Economics and Management</i> (S)
CHEM 533 <i>Nanostructure and Nanotechnology</i>	MGMT 617 <i>Managerial Decision Making</i> (S)
CHEM 547 <i>Supramolecular Chemistry</i> (F)	MGMT 636 <i>Systems Analysis and Database Design</i>
CHEM 630 <i>Molecular Spectroscopy and Group Theory</i> (F)	MGMT 661 <i>International Business Law</i> (F)
ELEC 561 <i>Topics in Semiconductor Manufacturing</i> (S)	MGMT 674 <i>Production and Operations Management</i> (F)
ELEC 562 <i>Submicrometer and Nanometer Device Technology</i> (S)	MGMT 676 <i>Project Management/Project Finance</i> (S)
ELEC 568 <i>Laser Spectroscopy</i> (F)	MGMT 721 <i>General Business Law</i> (S)
ELEC 603 <i>Nano-Optics and Nanophotonics</i> (F)	MGMT 751 <i>New Venture Creation in Science and Engineering</i> (S)
ELEC 645 <i>Thin Films</i> (F)	PHYS 569 <i>Ultrafast Optical Phenomena</i> (S)

**PROFESSIONAL SCIENCE MASTER'S 5TH YEAR DEGREE  
 OPTION FOR RICE UNDERGRADUATES**

Rice students have an option to achieve the MS in nanoscale physics by adding an additional 5th year to the four undergraduate years of science studies. Advanced Rice students in good standing apply during their junior year, then start taking required core courses of the nanoscale physics program during their senior year. A plan of study based on their particular focus area will need to be approved by the track director and the PSM coordinator.