

MASTER OF SCIENCE IN PHYSICS



Program overview

The Physics Master of Science program is open to full-time and part-time students who are planning to pursue careers in physics research or teaching, or in applied areas of industrial research and development. Ranked by the American Institute of Physics as one of the top physics MS programs in the United States, our program is designed to advance students' understanding of the concepts of modern and classical physics as well as their mastery of applying these concepts to solve practical problems.

The Physics Department offers a range of graduate courses in electrodynamics, quantum mechanics, relativity, fluid physics, mathematical physics, computational physics, nuclear physics and astrophysics. The Department also offers courses emphasizing research, including thesis research as well as independent study courses on special topics. Graduate students are strongly encouraged to participate in ongoing faculty research programs in various areas of theoretical and computational physics—namely, atomic physics, nuclear physics, relativity, astrophysics, high-energy and gravitational physics.

The Department offers three MS options: MS with Thesis; MS with Research Project; and MS with Comprehensive Examination.

Faculty and principal area of expertise

- ▶ **Sarah Caudill**, PhD, Louisiana State University, Assistant Professor. Specializations: Gravitational-wave searches for black holes and neutron stars, scientific computing, machine learning.
- ▶ **Robert Fisher**, (Graduate Program Director), PhD, University of California, Berkeley, Professor. Specializations: Fundamental physics of turbulent flows, scientific computing, star formation and supernovae.
- ▶ **Jong-Ping Hsu** PhD 1969 University of Rochester, Chancellor Professor. Specializations: Space-time symmetry, quantum Yang-Mills gravity, generalized gauge transformations with non-integral phase factors, and renormalizable model for quark confinement
- ▶ **David Kagan**, PhD, University of Cambridge, Full-time Lecturer in Physics. Specializations: String theory, quantum gravity, quantum theory.
- ▶ **Christian McHugh**, PhD, UNC Chapel Hill, Full-time Lecturer in Physics. Specializations: Medical physics, magnetic resonance imaging, chemical exchange NMR spectroscopy, hyperpolarized xenon.
- ▶ **Grant O'Rielly**, PhD, University of Melbourne, Associate Professor. Specializations: Photonuclear physics at intermediate energies, few-body systems, pion photo productions, fundamental nuclear symmetries.
- ▶ **Renuka Rajapakse**, PhD, University of Connecticut, Full-time Lecturer in Physics. Specializations: Quantum optics, computational physics, quantum computation and atomic physics.
- ▶ **Jay (Jianyi) Wang**, (Chairperson), PhD, University of Tennessee Knoxville, Professor. Specializations: Theory and simulations of electronic, atomic and optical processes, ion-solids and ion-surface interactions, computational physics.

Application requirements

Applicants must submit the application form and fee to the University's Office of Graduate Studies & Admissions. Applications are reviewed and judged on the following criteria:

- ▶ **Previous College Experience**—An official transcript from all institutions of higher education ever attended is required—either as an undergraduate or graduate student. The transcript must show dates attended, final grades, credits earned and, if appropriate, degree(s) earned;
- ▶ **Three letters of recommendation**, at least two of which should be from faculty members;
- ▶ **An essay of 200-300 words** describing the applicant's reason(s) for applying. One important use of this essay will be to assess how well the applicant's academic interests and long-range goals fit with the UMass Dartmouth graduate program to which the individual is applying;
- ▶ **TOEFL Exam**—candidates whose native language is not English, or who earned a baccalaureate degree in a non-English speaking country, must submit official scores from the Test of English as a Foreign Language Exam.

Admission to the graduate physics program may be for either the fall or the spring semester. Admission is competitive and requires the completion of an undergraduate degree in physics or a closely related field with a grade point average that attests to the student's ability for graduate level study. The General Record Examination (GRE) is not required for admission, but the selection of candidates for financial support includes consideration of GRE scores as well as TOEFL scores for international students whose native language is not English.

Degree requirements

Candidates for the MS degree in physics must complete a minimum of 30 semester hours of coursework, pursuant to one of the three options noted under "Program Overview." Graduate coursework comprises 500- and 600-level courses, although up to six credits of the total may be taken in advanced undergraduate (400-level) courses.

While the program is designed to meet a variety of professional needs, at least 15 credits of physics core courses are required. The remaining credits may be drawn from other engineering or science fields with prior approval of the Physics Graduate Program Director; from PHY 616 (Graduate Seminar); from research-based courses such as PHY 680 (Graduate Project), PHY 685 (Graduate Research), and PHY 690 (Master's Graduate Thesis); or from certain 400-level undergraduate Physics courses.

Financial assistance

A limited number of teaching and research assistantships are available. They are awarded on a competitive basis. The selection of candidates is based on an evaluation of: academic transcripts from all post-secondary institutions attended; three letters of recommendation from professors or other senior scientists well acquainted with the candidate's qualifications; GRE scores; and, where applicable, TOEFL scores. Assistantships are awarded either on a full-time or a part-time basis.

Departmental resources and facilities

- ▶ Observatory with 16" Meade Telescope
- ▶ Several high-performance computer clusters
- ▶ Access to a range of world-class supercomputers

Faculty highlights

- ▶ **Prof. Sarah Caudill** was part of the team that made the first detection of gravitational waves from a binary black hole merger in 2015 and was a co-recipient of the 2016 Breakthrough Prize in Fundamental Physics.
- ▶ **Prof. Robert Fisher** focuses his research on the fundamental physics of turbulent flows, and its application to star formation and supernovae.
- ▶ **Prof. J.P. Hsu** is co-author of *A Broader View of Relativity: General Implications of Lorentz and Poincare Invariance* (World Scientific Publications, 2006) and *Space-Time Symmetry and Quantum Yang-Mills Gravity* (World Scientific, 2013).
- ▶ **Prof. David Kagan** was awarded an FQXi minigrant to study the quantum physics of observers, published a paper in *Foundations of Physics* on the measurement problem and quantum dynamics of open systems (10.1007/s10701-020-00374-0), and completed a paper on new measures of quantum information (<https://arxiv.org/abs/2109.07447>).
- ▶ **Prof. Christian McHugh** works at the intersection of physics and biomedical engineering and has published medical imaging papers using each of the main modalities: CT, PET, ultrasound, and MRI. He focuses on molecular imaging and developing multi-modal contrast agents.
- ▶ **Prof. Grant O'Rielly** introduced Personal Response System radio transmitters into his classes to measure real-time student understanding of physics concepts.
- ▶ **Prof. Renuka Rajapakse** is working to set up a modern quantum optics and quantum information lab.
- ▶ **Prof. Jay Wang** introduced Computational Physics and Integration of Computation into the curriculum and helped establish the Computational Physics Lab with grants from the NSF and Research Corporation.

Physics graduate alumni highlights

Physics MS program graduates who have become professors or full-time faculty include:

Shiao-bai Ai—Chinese Academy of Science, Shanghai
Paul Eugenio—Florida State University
Ed King—UMass Dartmouth
Gerald Lemay—UMass Dartmouth
Linghong Li—Middle Tennessee State University
Hui Lu—University of Illinois at Chicago

Shou-Yong Pei—Beijing Normal University
Dominik A. Schneble—State University of New York at Stony Brook
Ling-jun Wang—University of Tennessee at Chattanooga
Hao Xin—University of Arizona

Physics MS program graduates now working for research institutions and major corporations or holding highly visible management positions include:

Lei He—Senior Software Development Engineer, Microsoft Dynamics AX development team, Microsoft Corporation. Microsoft Dynamics AX is an ERP (Enterprise Resource Planning) software geared towards mid-size companies. Redmond, MA.
Xiao-Yang Huang—President, Co-Founder of HDX International Inc from 2003 to present. Main business is custom LCD and LCD systems. Cuyahoga Fall, OH.
Warren (Yue-ren) Kang—Hepapro Corp., Vice President, company owner since 1998. Irvine, CA.
Wei Liang—Senior Software Engineer for Bioinformatics department of J. Craig Venter Institute. Manage and supervise several projects of genomic research data analysis software developments. Rockville, MD.
Jamie (Jianmin) Tan—Co-founder and Chief Technology Officer of Imaginestics, LLC, a visual search engine company that pioneered the technology for indexing and searching 3D models and images. West Lafayette, IN.
Chagarn B. Whan—Program Officer, Office of Navy Research, Department of the Navy. Arlington, VA.
Yong Zhang—President of Global Operations and Chief Operating Officer, Board Member and Corporate Secretary since 2005. Salary.com. Needham, MA.

Testimonials

“The second chapter of my life started at UMass, and I feel very lucky to have had the opportunity to be a part of the UMass family.”
Neda Masoud, M.S. Physics '11, Ph.D. Candidate in Civil Engineering, University of California at Irvine

“The diverse and interesting coursework at UMass Dartmouth prepared me well for graduate school. The faculty help each student individually realize their highest potential!”
Subir Sabharwal, M.S. Physics '08, Ph.D. Candidate in Physics, Arizona State University

For more information:

Dr. Robert Fisher
 Graduate Program Director
 508.999.8353
robert.fisher@umassd.edu

Please forward all credentials to:

Office of Graduate Studies & Admissions
 UMass Dartmouth
 285 Old Westport Road
 North Dartmouth, MA 02747-2300

Questions?
graduate@umassd.edu
 508.999.8604 voice
 508.999.8183 fax
umassd.edu/graduate