Medical Physics, M.S.

One of the basic science departments of the UW–Madison School of Medicine and Public Health, the Department of Medical Physics offers comprehensive training in diagnostic and therapeutic medical physics and in health physics. Achievement of the M.S. or Ph.D. in this department reflects strong scholarship in one of the top medical physics programs in the United States. Graduates are prepared for teaching, research, and clinical physics positions in medical centers, national laboratories, and universities, and in the medical and nuclear technology industries.

Medical physicists may participate professionally in the radiation treatment of cancer patients, in advanced medical imaging and diagnostic procedures, or in related areas of research and teaching. Health physicists may operate radiation protection programs at nuclear industrial facilities, hospitals, or laboratories, or may perform research on methods of measuring ionizing radiations (i.e., dosimetry).

A unique quality of the medical physics program is the broad range of expertise and research interests of the faculty. Students receive training in diagnostic x-ray physics, x-ray computerized tomography, magnetic resonance imaging and spectroscopy, nuclear medicine and positron emission tomography (PET) imaging, biomagnetism, medical ultrasound, elastography, radiation dosimetry, radiation treatment planning, and radiobiology.

The Ph.D. is primarily a research degree that extends the student’s depth of knowledge in one of the specialty areas. Faculty positions at universities, research positions, and an increasing number of clinical physics positions require the Ph.D. degree. Medical physics faculty maintain close collaborative ties with faculty in other departments, including human oncology, radiology, cardiology, medicine, psychiatry, and pharmacology, broadening the scope of research opportunities open to medical physics students and providing access to sophisticated clinical facilities.

The department also houses the Medical Radiation Research Center and Accredited Dosimetry Calibration Laboratory, one of four in the U.S. accredited by the American Association of Physicists in Medicine. In addition, the department provides clinical support services to the radiology and human oncology departments. It also operates a PET radiotracer production facility, a medical image analysis laboratory, and a small bore MRI scanner in the medical school’s small animal imaging laboratory. Each of these facilities provides unique training and support for graduate students.

Funding

The department typically supports 85–90 percent of students enrolled in the medical physics graduate program through department or university fellowships, research or teaching assistantships, or NIH–NRSA traineeships. All awards include a comprehensive health insurance program and remission of tuition. The student is responsible for segregated fees.

Requirements

Minimum Degree Requirements and Satisfactory Progress

To make progress toward a graduate degree, students must meet the Graduate School Minimum Degree Requirements and Satisfactory Progress (http://guide.wisc.edu/graduate/#policiesandrequirementstext) in addition to the requirements of the program.

Master’s Degrees

M.S.

Minimum Graduate Degree Credit Requirement

32 credits

Minimum Graduate Residence Credit Requirement

29 credits

Minimum Graduate Coursework (50%) Requirement

Half of degree coursework (16 out of 32 total credits) must be in graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide (http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle).

Prior Coursework Requirements: Graduate Work from Other Institutions

With program approval, students are allowed to count no more than 3 credits of graduate coursework from other institutions. coursework earned five or more years prior to admission to the master’s degree program is not allowed to satisfy requirements.

Prior Coursework Requirements: UW–Madison Undergraduate

With program approval, 7 credits in medical physics courses from a UW–Madison undergraduate degree above the undergraduate graduation requirements are allowed to count toward the degree.

Prior Coursework Requirements: UW–Madison University Special

With program approval, students are allowed to count no more than 15 credits of coursework numbered 500 or above taken as a UW–Madison Special student. Coursework earned five or more years prior to admission to the master’s degree program is not allowed to satisfy requirements.

Credits Per Term Allowed

15 credits

Program-Specific Courses Required

All students in the program are required to take 8 core curriculum courses, namely MED PHYS/B M E/H ONCOL/P HYSICS 501 Radiological Physics and Dosimetry, MED PHYS/P HYSICS 563 Radionuclides in Medicine and Biology, MED PHYS/B M E 566 Physics of Radiotherapy, MED PHYS/B M E 567 The Physics of Diagnostic Radiology, MED PHYS/N E 569 Health Physics and Biological Effects, MED PHYS/B M E 573 Medical Image Science: Mathematical and Conceptual
Foundations, MED PHYS/B ME 578 Non-Ionizing Diagnostic Imaging, and MED PHYS 701 Ethics and the responsible conduct of research and practice of Medical Physics along with associated laboratories (totaling 25 credits). These core courses, along with an acceptable course in anatomy / physiology, satisfy CAMPEP course requirements. Masters degree students must also complete 2 credits of Journal Club (MED PHYS 990 Research).

Health Physics: Candidates must complete 8 core courses totaling 25 credits, including MED PHYS/B M E/H ONCOL/PHYSICS 501 Radiological Physics and Dosimetry, MED PHYS/PHYSICS 563 Radionuclides in Medicine and Biology, MED PHYS/B M E 566 Physics of Radiotherapy, MED PHYS/B M E 567 The Physics of Diagnostic Radiology, MED PHYS/N E 569 Health Physics and Biological Effects, MED PHYS/B M E 573 Medical Image Science: Mathematical and Conceptual Foundations, MED PHYS/B M E 578 Non-Ionizing Diagnostic Imaging, and MED PHYS 701 Ethics and the responsible conduct of research and practice of Medical Physics plus an independent reading course on Health Physics Rules and Regulations for 1 credit. N E 427 Nuclear Instrumentation Laboratory and N E 571 Economic and Environmental Aspects of Nuclear Energy must also be taken. In addition, 6 elective credits are required. anatomy for 3 credits or physiology for 5 credits (or alternative) is required as one of the electives. This is a total of 36 credits, including 2 credits of Journal Club (MED PHYS 990 Research).

An exemption from the core curriculum requirement requires the approval of the chair of the Graduate Committee. If the entirety of the core curriculum is not taken, the student will not satisfy the CAMPEP core curriculum requirement.

OVERALL GRADUATE GPA REQUIREMENT
3.00 GPA required.

OTHER GRADE REQUIREMENTS
See Medical Physics Graduate Student Handbook (http://www.medphysics.wisc.edu/graduate/documents/handbook_june_2014.pdf) for department criteria for satisfactory academic progress.

PROBATION POLICY
See Medical Physics Graduate Student Handbook (http://www.medphysics.wisc.edu/graduate/documents/handbook_june_2014.pdf) for more information.

ADVISOR / COMMITTEE
Candidates must acquire a major professor/advisor by the beginning of the second semester of study.

ASSESSMENTS AND EXAMINATIONS
Candidates are expected to take the qualifying examination by the end of the second year of study. Contact the department for more information.

TIME CONSTRAINTS
The qualifying examination should be taken by the end of the second year. Master's degree course requirements should be completed by the end of the second year.

LANGUAGE REQUIREMENTS
No language requirements.

ADMISSIONS
About 150 applicants per year are attracted to the medical physics program. Each fall the program admits 15–20 students based on academic record. This results in an average enrollment of approximately 100 students each semester. Less than one-fourth of the students pursue the M.S. degree as a terminal degree, and the remainder continue on to the Ph.D.

A bachelor’s degree in physics is considered the best preparation for graduate study in medical physics, but majors such as nuclear engineering, biomedical engineering, electrical engineering, or chemistry may also be acceptable. The student’s math background should include calculus, differential equations, linear algebra, and Fourier analysis, such as might be learned in modern optics or undergraduate quantum theory. Some facility in computer programming and electronic instrumentation is desirable. One year of chemistry, a year of biology, and an introductory course in physiology are also advantageous.

Beginning graduate students should start their studies in the fall semester, as the course sequence is based on that assumption. Students applying for admission should submit an online application and all supporting documentation by December 1 (for domestic applications; international applications are due November 15), to ensure consideration for admission and financial support to begin the following fall.

Admission to the graduate program is competitive. Applications are judged on the basis of a student’s previous academic record, Graduate Record Exam (GRE) scores, research experience, letters of recommendation, and personal statement of reasons for interest in graduate study in medical physics.

The application process is in two parts:

1. Complete the online application to the Graduate School and pay application fee.
2. Provide electronic copies of resume (include awards, fellowships, and scholarships received, publications, volunteer activities, and research experience); the “applicant data sheet”; personal statement of reasons for interest in graduate study in medical physics; and mail two official sets of paper transcripts to the department. Note: Recommendation letters are submitted electronically through the online application. To report Graduate Record Exam (GRE) scores, use Institution Code 1846 for the University of Wisconsin–Madison.

LEARNING OUTCOMES

KNOWLEDGE AND SKILLS
• Articulates, critiques, and/or elaborates theories, research methods, and approaches to inquiry or schools of practice in the field of medical physics.
• Identifies sources and assembles evidence pertaining to questions or challenges in the field of medical physics.
• Selects and/or utilizes the most appropriate methodologies and practices.
• Evaluates and/or synthesizes information pertaining to questions or challenges in the field of medical physics.
• Communicates clearly in both oral and written formats.
PROFESSIONAL CONDUCT

- Fosters ethical and professional conduct.

PEOPLE

Faculty: Professors Jackson (chair), Alexander, Bayouth, Block, Campagnola, Chen, Christian, DeJesus, DeWerd, Fain, Grist, Hall, Henderson, Jeraj, Korosec, Meyerand, Peppler, Reeder, Thomadsen, Varghese, Wakai; Associate Professors Brace, Cai, Emborg, Ranallo, Vetter, Weichert, Wieben; Assistant Professors Bednarz, Birn, Culberson, Kissick, Li, Nagle, Prabhakaran, Smilowitz, Speidel; Emeritus Professors DeLuca, Holden, Mackie, Madsen, Mistretta, Nickles, Paliwal, Van Lysel, Zagzebski