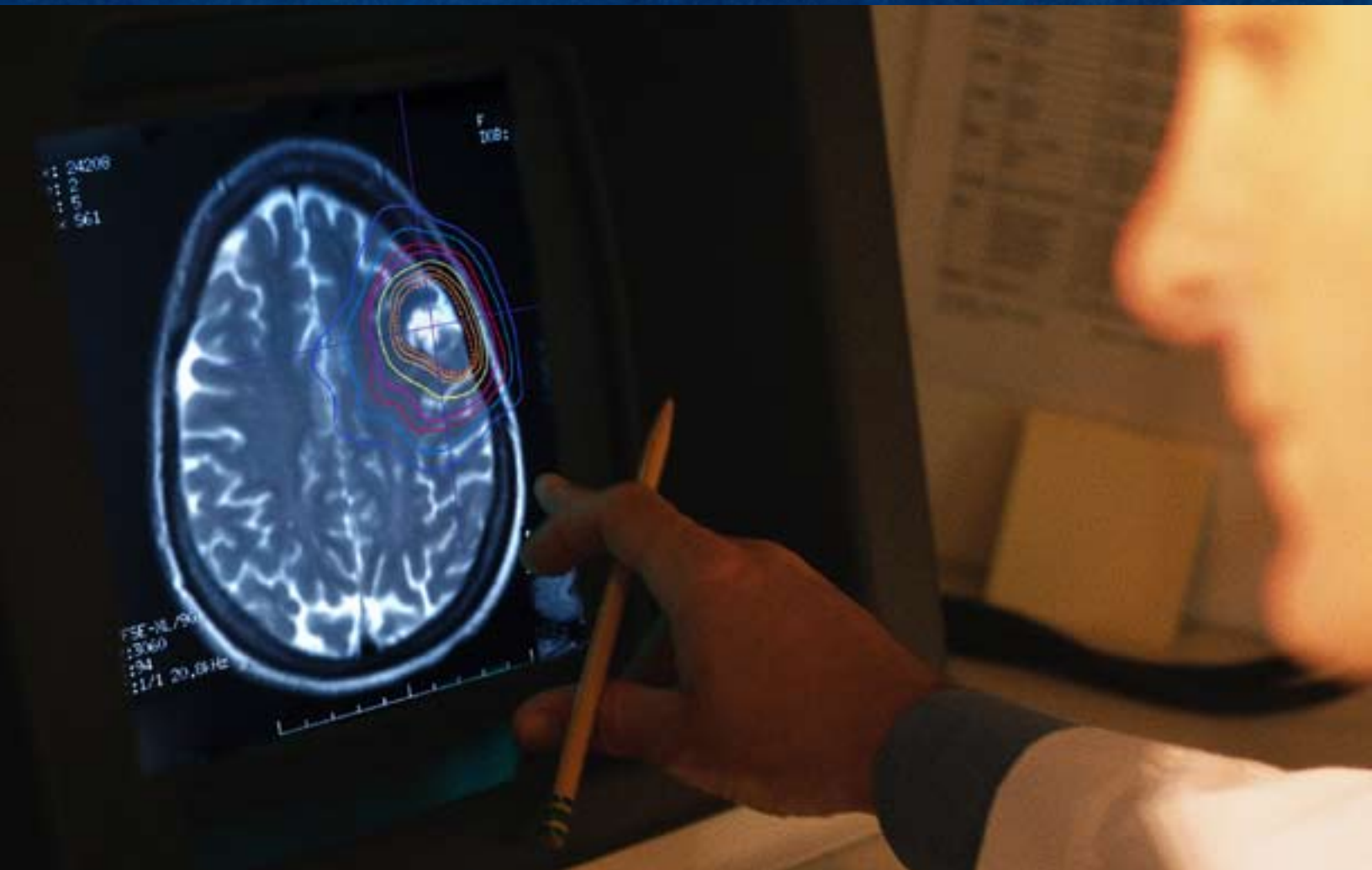


# MASTER *of* Medical Physics



College of Liberal & Professional Studies  
**Penn LPS**

*"Hide not your talents. They for use were made.  
What's a sundial in the shade?"*

*Benz. Franklin*

PENN FOUNDER

# MASTER *of* Medical Physics

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*energized* Thinking!

The University of Pennsylvania values diversity and seeks talented students, faculty and staff from diverse backgrounds. The University of Pennsylvania does not discriminate on the basis of race, sex, sexual orientation, gender identity, religion, color, national or ethnic origin, age, disability, or status as a Vietnam Era Veteran or disabled veteran in the administration of educational policies, programs or activities; admissions policies; scholarship and loan awards; athletic, or other University administered programs or employment. Questions or complaints regarding this policy should be directed to: Executive Director, Office of Affirmative Action and Equal Opportunity Programs, Sansom Place East, 3600 Chestnut Street, Suite 228, Philadelphia, PA 19104-6106 or by phone at (215) 898-6993 (Voice) or (215) 898-7803 (TDD).

The federal Crime Awareness and Campus Security Act requires Penn to provide information on its security policies and procedures and specific statistics for criminal incidents and arrests on campus to students and employees, and to make information and statistics available to prospective students and employees on request. The College and University Security Information Act requires Penn to provide information on its security policies and procedures to students, employees, and applicants; and to provide crime statistics to students and employees, and make those statistics available to applicants and prospective employees upon request. This information is available by calling the Division of Public Safety at 215.898.7297.

# ENERGIZE

your thinking, scientific knowledge, and medical discovery in the Master of Medical Physics program.

Our Master of Medical Physics program is one of the nation's best and most selective—and it's set within a university that is recognized worldwide for its top-rated Department of Physics, its School of Medicine, and its dedication to both scientific and clinical research. In our Master of Medical Physics program, you'll receive an exceptionally well-rounded medical physics education, balancing classroom, laboratory, and clinical experiences, as you pursue an exciting, challenging, and lucrative career in medical specialties such as radiation oncology and medical imaging.

You will be introduced to both clinical and research aspects of medical physics through the University of Pennsylvania Health System's state-of-the-art therapy and imaging facilities and may be selected to stay on for a two year medical physics residency. Our graduates are sought by top hospitals and university medical facilities.

Learn more about how you can energize your mind and your talents in the Master of Medical Physics program.





# The Master of Medical Physics

Best known as one of the Founding Fathers of the United States, Benjamin Franklin was also a natural philosopher—the precursor of the word “scientist”—who made substantial contributions to the study of physics with his discovery that lightning is a form of electricity.

His experiment with a kite during an electrical storm led to his discovery of positive and negative electricity and to his development of terms still in use today: battery, conductor, condenser, charge, discharge, and electric shock.

But Franklin also took a great interest in health-related topics, applying Enlightenment reasoning to his study of various afflictions and coming up with some surprisingly accurate hypotheses to explain the common cold and ailments caused by lead poisoning. In 1751, he undertook a fundraising campaign to create the first public hospital in the American colonies, the Pennsylvania Hospital in Philadelphia.

The Master of Medical Physics (MMP) program at the University of Pennsylvania brings Franklin’s early interest in physics and medicine into the twenty-first century. Offered by Penn’s Department of Physics and Astronomy in the School of Arts and Sciences in conjunction with the Departments of Radiology and Radiation Oncology in the University of Pennsylvania School of Medicine, the MMP program meets the academic and career interests of technically prepared college graduates who seek to combine their interests in graduate physics with growing career opportunities

in the field of medicine. The practice of modern medical physics requires highly educated and well-trained problem solvers to aid in development, implementation and on-going maintenance of highly technical clinical equipment.

The MMP program provides students with rigorous training in essential graduate physics courses as well as more traditional coursework in anatomy, radiation biology and medical physics. The program offers a well-rounded education, balancing classroom, laboratory, and clinical experiences. Students will be introduced to both clinical and research aspects of medical physics through the University of Pennsylvania Health System’s (UPHS) state-of-the-art medical imaging and therapy facilities. The program also stresses communication, ethics, and responsibility (in both clinical and research settings), promoting the highest possible standards in patient care.

The traditional problem-solving techniques emphasized in physics graduate training will enable students to address a wide variety of problems encountered in the modern medical environment and to evolve with the field as it continues to embrace the most advanced technologies.

# What is Medical Physics?

Medical physics is the branch of physics associated with the practice of medicine. It includes the specialties of therapeutic radiological physics, diagnostic imaging physics, nuclear medicine physics, and medical health physics (radiation protection).

Medical physicists contribute to the effectiveness of radiological imaging procedures by assuring that best radiation safety practices are followed (reducing radiation dose to patients and staff) and helping to develop improved imaging techniques (e.g., mammography CT, MR, ultrasound). They contribute to the development and implementation of therapeutic techniques (e.g., external beam, brachytherapy, HDR, stereotactic radiosurgery), collaborate with radiation oncologists to design and execute patient specific treatment plans, and monitor equipment and procedures to insure that cancer patients receive the prescribed dose of radiation to the correct location, while minimizing the radiation dose to surrounding normal tissue.

For more information about the practice of medical physics, visit the web site of the American Association of Physicists in Medicine, [www.aapm.org](http://www.aapm.org).

## The Roberts Proton Therapy Center

On January 29, 2008, the Hospital of the University of Pennsylvania welcomed an extraordinary new colleague in its fight against cancer and a powerful tool in training medical physicists—a cyclotron that took up residence in HUP's new Roberts Proton Therapy Center.

Following a 3,700 mile trip from Belgium, the final leg of the cyclotron's journey required a 19-axle trailer with a police escort. The machine, which at 220 tons weighs about the same as a 747, accelerates atoms to near light speeds to create a tightly targeted beam of energy that can kill cancerous tumors without harming nearby healthy tissue or organs.

The Roberts Proton Therapy Center, scheduled to open in 2009, will be the largest proton therapy center of its kind in the world—eventually treating 3,000 patients a year—and one of only six such centers in the country. It will also be unique in its ability to fully integrate conventional radiation treatment and proton radiation with medical and surgical treatment of cancer.

The Proton Therapy Center is the centerpiece of the new Perelman Center for Advanced Medicine (CAM). CAM is a state-of-the-art outpatient facility (also housing Penn's Abramson Cancer Center and the Department of Radiation Oncology) designed to create an ideal environment for patient-focused care and collaboration among health-care professionals.

## Medical Physics Residencies

After graduation, outstanding MMP students may be selected to enter a Medical Physics Residency program in the University of Pennsylvania Health System (UPHS). This program is one year in length, renewable for a second year. This clinical experience would count toward the requirements for certification by the American Board of Radiology.



# The MMP Curriculum

Fifteen course units at the graduate level are required for the MMP degree.

Full-time students will complete the program in two years. In the second year, students will spend a significant amount of their time completing appropriate clinical rotations in the University of Pennsylvania Health System. Part-time study may be possible, and will be considered on an individual basis by the program director.

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## During the first year, students will take eight required courses (for a total of 7 course units):

- Mathematical Methods (or Electromagnetism I)
- Introduction to Radiation Protection
- Anatomy and Physiology (as required by the American Board of Radiology)
- Radiologic Physics and Dosimetry
- Advanced Laboratory (with Medical Physics-specific experiments added)
- Electromagnetic Theory (or Electromagnetism II)
- Physics of Radiation Therapy
- Medical Ethics and Governmental Regulations

In addition, first year students will be required to complete an Introductory Practicum rotation, where they will be introduced to the various specialties of medical physics (radiation oncology, diagnostic imaging, nuclear medicine, and medical health physics).

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## During the second year, all students will take three required courses (for a total of 3 course units):

- Physics of Medical Imaging
- Radiation Biology (as required by the American Board of Radiology)
- Mathematics for Medical Imaging (or Molecular Imaging)

Students beginning their second year are required to select an area of clinical concentration. Students will then complete a two semester clinical practicum (approximately 250 contact hours and 2 course units) in their chosen area. Additionally, with the guidance of their academic advisor or program director, students will select an additional three course units from such electives as Biological Physics, Optical Imaging, Cancer Biology, and Quantitative Image Analysis. With guidance from the practicum advisor, the student will also select an appropriate topic or project and will prepare a paper of appropriate length and presentation to be given at the end of the semester.

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**All students in the MMP program are also required to attend the non-credit Medical Physics Seminar Series. This clinically oriented series surveys the various subspecialties of medical physics as well as more general physics topics.**

# The Penn Libraries

The University of Pennsylvania Library consists of 15 separate libraries that house more than five million printed volumes and three million microtext items, sound recordings, DVDs, and video.

This does not include the more than 38,000 current serials and 9,000 e-journals to which Penn subscribes, nor the 400-plus online databases and indices available through the Penn library website.

Penn's library system also offers two specialized libraries of particular interest to students in the Master of Medical Physics program.

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## Mathematics-Physics-Astronomy Library

[WWW.LIBRARY.UPENN.EDU/SCITECH](http://WWW.LIBRARY.UPENN.EDU/SCITECH)

The collection of more than 52,000 volumes and nearly 600 current serials supports teaching and research in mathematics, physics, and astronomy, and is particularly strong in high-energy physics, astrophysics, topology, algebraic geometry, and Riemannian geometry. The Math-Physics-Astronomy Library also provides major electronic indexes and abstracts to the literature of mathematics and physics, including MathSciNet, INSPEC, Scopus, and the Science Citation Index. Many journals are available in full-text electronic form.

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## Biomedical Library

[WWW.LIBRARY.UPENN.EDU/BIOMED](http://WWW.LIBRARY.UPENN.EDU/BIOMED)

With more than 114,500 volumes and 4,000 current serials in print and electronic form, the services and collections of the Biomedical Library support research, education, and patient care decisions for the University of Pennsylvania Health System, the Schools of Medicine and Nursing, Biomedical Graduate Studies, and the Department of Biology. Collections emphasize the most current material available. In addition to the relevant databases online, the Library provides e-journals including over 3,600 titles in nursing, biology, medicine, and health care; 200 e-books; and PDA-accessible content. The Library houses a 40-station computer center, conference and group study facilities, a computer training laboratory, and library-wide wireless network. Staff provide in-library and off-site training in searching medical and biological databases, bibliographic management tools, general library research skills, and evidence-based practice principles. Through the Library's Liaison-Outreach Program, staff are available to speak to classes, departments, or larger groups on library and information science topics. Staff also provide individual consultations.





# The College of Liberal and Professional Studies

The University of Pennsylvania took a highly unusual step for a venerable research university, particularly in the Ivy League, when it opened its college courses to local Philadelphia teachers in 1892.

A division of Penn's School of Arts & Sciences—the area of the University that is home to the humanities, the social sciences, and the natural sciences—LPS continues to honor its core mission to offer an undergraduate education to highly qualified adult students seeking to begin or complete their bachelor's degrees. In recent years, LPS has also become a magnet for an audience comprised not only of adult students working toward undergraduate degrees but of students seeking post-baccalaureate study in professional master's and pre-professional programs in the humanities and the natural and social sciences.

Whatever the level of their studies, students at the College of Liberal and Professional Studies are intellectually capable adults who are fully engaged in their work, and for whom a Penn degree or individual

courses serve two fully integrated aims: intellectual and personal enrichment, and career or academic advancement. These students come not only from Philadelphia and its environs but from all over the country—indeed, many of them come from abroad—specifically to study in LPS' innovative, multi-disciplinary programs.

Our students embody the values of the School of Arts and Sciences' commitment to bring knowledge, analysis, creativity, innovation, and invention to bear on society's most critical problems. These students are engaged in the world. They come to Penn with a sense of purpose and urgency and a strong sense of the problems facing the world in the 21st century, and they bring to Penn a unique combination of intellectual talent, maturity, and a broad spectrum of experience.

# The University of Pennsylvania

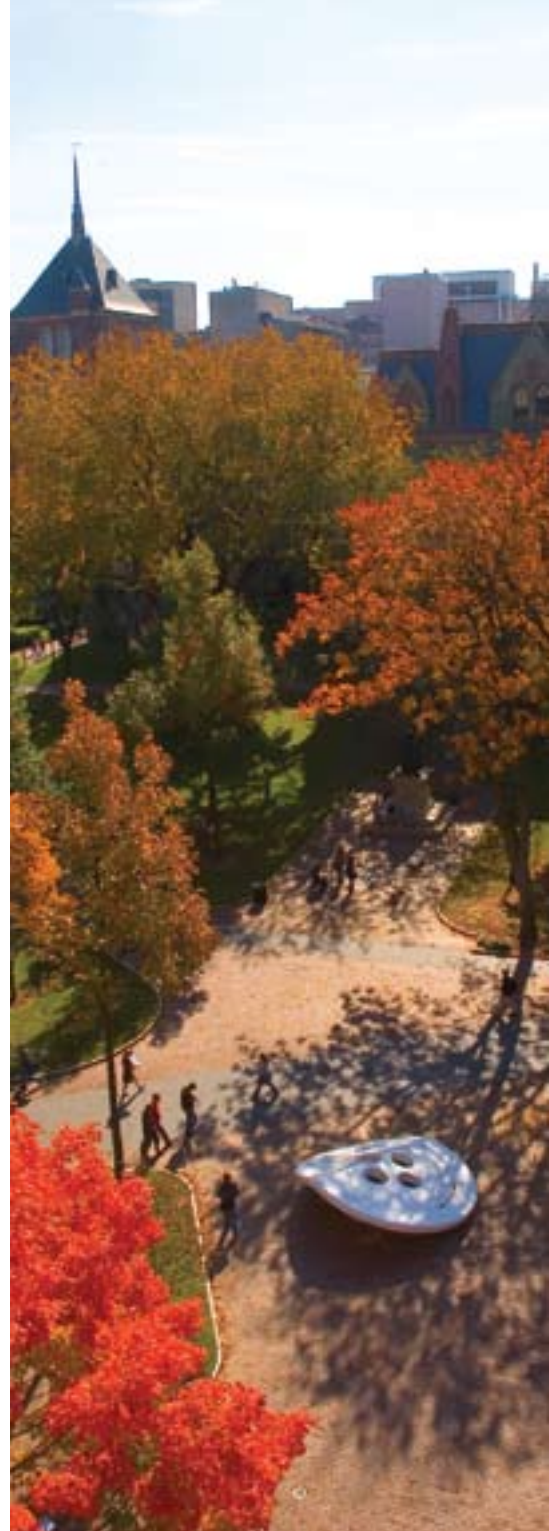
When you become a student at the University of Pennsylvania, you are joining an extraordinary community of thinkers and doers at one of the greatest centers of learning in the United States.

The University of Pennsylvania was founded by American Colonial statesman Benjamin Franklin, a true Renaissance man known for his devotion to education, his support for intellectual pursuits, and his commitment to the public good. He was a successful entrepreneur, printer, and inventor. In 1749, Franklin outlined a progressive college: one that would offer practical as well as classical instruction. Unlike other American Colonial colleges, Franklin's college would not focus on education for the clergy, but would instead prepare students for lives of business and public service. The proposed program of study would become the nation's first modern liberal arts curriculum.

More than 250 years later, Penn continues to blaze trails in education. The University of Pennsylvania, one of eight private universi-

ties known as the Ivy League, is consistently ranked as one of the best national universities in the U.S.A. In their 2007 rankings, *US News & World Report* ranked Penn #7 out of 248 national universities. There are more than 23,000 students at Penn, including 4,500 international students. More than 4,000 faculty members teach at Penn, including ten who have received Nobel Prizes in recent years.

Recognized as America's first university, Penn remains today a world-renowned center for the creation and dissemination of knowledge and serves as a model for research colleges and universities throughout the world.





# Admissions, Tuition and Financial Information

Applicants to the Master of Medical Physics program are evaluated according to a number of criteria.

## MMP Admissions

Successful applicants will have strong academic credentials and will hold an undergraduate degree in physics, a physical science, mathematics, or a related engineering discipline with the equivalent of a minor in physics (6 physics courses). Applicants should have successfully completed intermediate-level coursework in electromagnetism and have taken at least four semesters of college-level calculus, including differential equations. In addition, intermediate-level quantum mechanics (or modern/nuclear physics) and two semesters of college-level chemistry are preferred.

Prospective applicants who have not completed all of these prerequisites are still encouraged to apply and will be considered on a case-by-case basis.

## Application

Applications may be submitted only through our on-line application system. An application must contain all of the following in order to be considered complete:

- Completed application form
- A professional résumé
- Non-refundable application fee of \$70
- Application essays
- Transcripts from each post-secondary school attended
- Three letters of recommendation
- GRE General Test score report
- TOEFL score report, for applicants for whom English is not their primary language

## Application Deadlines

Priority Admission Deadline: January 15

Regular Admission Deadline: March 1

## Tuition and Financial Information

Students in the Master of Medical Physics program primarily pay regular School of Arts and Sciences graduate tuition on a per-course basis. Courses taken in the School of Medicine or the School of Engineering and Applied Science are billed at the rate of the applicable school. Up-to-date information on tuition and fees can be found on our web site, [www.sas.upenn.edu/lps/graduate/mmp/tuition](http://www.sas.upenn.edu/lps/graduate/mmp/tuition).

Full-time students are eligible for financial aid (up to full tuition and living expenses), including Stafford and Perkins Loans, Work-Study and Alternative Loans. To receive more information and an application, contact Graduate/Professional Student Counseling at 215.573.3393 or visit Student Financial Services at [www.sfs.upenn.edu](http://www.sfs.upenn.edu).

# Philadelphia

*Penn's picturesque campus is situated near the heart of Philadelphia, a vital and lively city.*

One of the most historic cities in the United States, Philadelphia was the nation's capital from 1790 to 1800, and it is where the Declaration of Independence was signed and where the Constitution of the United States was written. Philadelphia has a population of 1.8 million, making it the fifth largest city in the U.S. The city's historic, artistic, and commercial centers are located a short distance from the University of Pennsylvania. Our students and faculty enjoy both campus life and the expansive cultural offerings of the city. Penn makes a substantial investment in its surrounding neighborhood and offers ways for students and faculty to make community service part of their educational experience.



PHOTOS BY B. KRIST, R. KENNEDY, R. NOWITZ, J. SMITH FOR GPTMC



220-TON CYCLOTRON, LOCATED IN THE ROBERTS PROTON THERAPY CENTER



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**Penn LPS**

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