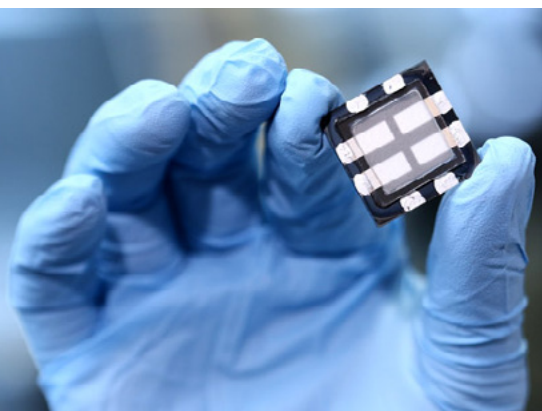


Ph.D. DEGREE PHYSICS Materials Science Concentration



The doctoral degree in physics prepares students to enter research careers in academic, government and industrial settings. Non-research careers in a variety of areas, including public policy, science communication, intellectual property law and science education, are also possible.

UToledo graduate programs in Physics and Astronomy develop a strong and broad foundation in fundamental physics, while simultaneously teaching the mathematical and problem-solving skills necessary to advance knowledge of our physical world. Coursework is tailored to your specific area of research concentration, with flexibility, so you acquire the skills necessary to complete an innovative, important and original thesis research project.

UToledo boasts nationally and internationally recognized faculty members in physics and astronomy. Students in our Ph.D. in Physics with Materials Science concentration focus on understanding the behavior of materials for technological applications, such as high efficiency thin film solar cells, and spend most of their time conducting research to complete their thesis. They are expected to publish several papers in peer-reviewed journals and present at conferences.

Physics Ph.D. Degree Highlights:

- **Financial support.** Graduate physics students are supported through teaching and research assistantships. We also offer incentive and stipend enhancements for exceptionally qualified applicants.
- **International reputation in photovoltaics.** Toledo and the State of Ohio have a long history of success in the photovoltaics industry. That history, along with The University of Toledo's expertise in PV science and technology, led to the creation of the [Wright Center for Photovoltaics Innovation and Commercialization](#).
- **High-tech labs and research facilities.** UToledo physics graduate students have access to: state-of-the-art equipment in the Wright Center for Photovoltaics Innovation and Commercialization; several parallel computing clusters, as well as access to the Ohio Supercomputer Cluster; and the Toledo Heavy Ion Accelerator (THIA).
- **Research opportunities.** Faculty and students in UToledo's Department of Physics and Astronomy work closely to conduct world-class research. Ph.D. students pursuing the materials science option may conduct research involving: the theoretical study of equilibrium and non-equilibrium surface physics and materials science; strongly correlated electron systems including lanthanide organometallics and actinide intermetallic superconductors using X-ray absorption spectroscopy techniques, including XANES, EXAFS and RIXS; film growth mechanisms and structure to identify nucleation and growth behavior as well as phase changes in thin films; and much more.

PROGRAM OVERVIEW

Ph.D. Degree in Physics with Materials Science Concentration

The doctoral degree in physics is awarded to a student who has demonstrated mastery in the field of physics and a distinct and superior ability to make substantial contributions to the field. The quality of work and the resourcefulness of the student must be such that the faculty can expect a continuing effort toward the advancement of knowledge and significant achievement in research and related activities. Publication of research in peer-reviewed journals is expected.

The degree provides a foundation in photovoltaics and condensed-matter physics consisting of theory and experiment. A strong training may be expected in research methodologies and practices, rigorous hypothesis-driven scientific investigation and the dissemination of research results and ideas through scholarly article publication as well as presentation at conferences, other universities and research settings. In general, work for the Ph.D. takes approximately five years of study beyond the bachelor's degree.

A substantial portion of this time is spent in independent research leading to a dissertation. Normally, 90 credit hours of study beyond the bachelor's degree are required for the Ph.D. Students may opt to obtain a M.S. degree during their Ph.D. program.

We encourage you to contact individual faculty members directly to discuss research interests and opportunities.

Faculty contact information is available at: utoledo.edu/nsm/physast/research

Faculty Member	Area(s) of Research
Amar, Jacques	Theoretical condensed matter physics, materials science and surface physics
Collins, Robert	Condensed matter physics, optical properties of solids and thin solid films
Deng, Xunming.....	Materials science, thin films and photovoltaics
Ellingson, Randall	Ultrafast laser spectroscopy, photophysics of semiconductor nanocrystals and nanocrystalline films
Heben, Michael	Nanoscience, materials for energy conversion and storage
Karpov, Victor	Theoretical condensed matter physics and photovoltaics
Khare, Sanjay	Theoretical condensed matter physics and materials science
Lee, Scott	Biophysics and high-pressure physics
Medling, Scott	X-ray absorption spectroscopy
Podraza, Nikolas	Condensed matter and photovoltaics
Smith, J.D.	Infrared and extragalactic astronomy
Yan, Yanfa.....	Materials science, condensed matter and photovoltaics

The Ph.D. in Physics with Materials Science concentration satisfies all the requirements for the Ph.D. in physics while preparing you for a career in materials science.

In addition, the concentration requires:

- Two core courses in the fundamentals of materials science: PHYS 8540 (Structure, Defects and Diffusion) and PHYS 8550 (Thermodynamics and Phase Transformations in Condensed Systems)
- Two additional elective courses in materials science and engineering chosen from a list of courses approved by the student's Ph.D. committee
- A dissertation in a materials-related field with a supervisor who is actively working in the field of materials research

What to expect when you graduate ...

Graduates of UToledo's Ph.D. program in physics typically advance to postdoc programs or take jobs in the industry.

Alumni of UToledo's graduate programs in physics have landed positions at institutions such as: University of Chicago, Baker College, Rensselaer Polytechnic Institute, Ohio State University, Pacific Northwest National Laboratory, NASA, Intel Corporation, Boeing Company and the Raytheon Company.

Admission requirements, guidelines, and application information can be found at: utoledo.edu/graduate/apply.

If you have questions about the application process, contact 419.530.4723 or graduateonlineapplication@utoledo.edu.