Missouri S&T Department of Physics
Graduate Studies in Rolla, Missouri:
An Attractive Alternative for Ambitious Students

The physics department of Missouri University of Science and Technology invites applications of students for the graduate program in theoretical and experimental physics. Rolla, Missouri, features attractive surroundings within the Ozarks, with the Meramec, Gasconade and Missouri Rivers close by. Rock formations like Iron Mountain, the Taum Sauk State Park and the Johnson Shut-Ins are a short drive away. The Lake of the Ozarks offers close-by resorts within an attractive environment.

In Rolla, living expenses are low on a national average and housing is available on campus and within walking distance of the University. International shops close to campus reflect the diverse student body of the University, from the Americas, India, the Middle East and Europe. In 2015, more than 50 country-specific contributions registered for the annual Celebration of Nations Parade that is traditionally held in early fall.

The department has a strong presence in theoretical and experimental atomic physics, and cloud and atmospheric physics, as well as in solid-state and computational physics, with a combined theoretical-experimental profile. Four of the faculty members are Fellows of the American Physical Society, and three carry the title of Curators’ Professor within the Missouri University system. The department counts seven active research projects supported by the National Science Foundation. Chancellor’s Fellowships are available to support domestic graduate students.

**Atomic Physics:** The atomic physics group has four members three of whom (Schulz, Fischer, Jentschura) previously worked at Heidelberg University, and at the Max–Planck–Institute for Nuclear Physics in Heidelberg. **Dr. Michael Schulz** (APS Fellow) is one of the world’s leading experts in experimental atomic collision research. His results have led to major advancements in our understanding of the fundamentally important quantum few-body problem. The group of **Dr. Daniel Fischer** combines laser physics techniques with collision studies, in order to extract additional information on the dynamics of atomic systems.
Dr. Ulrich Jentschura (APS Fellow) studies the theory of dynamic processes in atoms, and quantum field theoretical effects in simple atomic systems, using a combination of analytic and numerical methods. These studies have led to some of the most accurate predictions of atomic transition frequencies available to date. His group also is active in the theory of high-energy laser physics, using relativistic quantum theory, and he combines quantum mechanics with general relativity. His work was mentioned in the Nobel lecture of Prof. Dr. Theodor W. Hänsch of 2005, recognizing the importance of theoretical calculations of energy levels in simple atomic system. Dr. Don Madison (APS Fellow) is one of the world’s leading scientists in the theory of atomic collisions; his research currently focuses on the molecular aspects of collision processes, and the electron-electron interaction contributions to the atomic and molecular collision processes.

Dr. John G. Story demonstrated nuclear fusion in a laboratory as an undergraduate project in 2014, and regularly wins the students’ acclaim for his excellent teaching of courses in laser physics. Together with Dr. Don Madison, Dr. Jerry L. Peacher maintains a research interest in the theory of atomic collisions. The atomic physics group cordially invites students with interests in both experimental and theoretical studies of the fundamental aspects of quantum mechanics.

Condensed Matter Physics: Dr. Yew San Hor, previously of Princeton University, has been counted among one of the most highly cited physicists over the last five years by Thomson Reuters. He leads an experimental solid-state program which has succeeded in producing sophisticated crystal structures, which serve as models for axion terms within the crystal lattice. The group led by Dr. Cihan Kurter, who recently joined the department from the University of Illinois at Urbana–Champaign, uses low-temperature transport techniques to study mesoscopic superconducting junctions and devices.

Dr. Thomas Vojta (APS Fellow) is studying phase transitions in superconductors and the properties of exotic crystal lattices using Monte Carlo simulations on a powerful in-house supercomputer system, sup-
plemented by scaling arguments (renormalization-group methods). **Dr. Alexey Yamilov** investigates wave propagation in complex media and conducts analytical and numerical modeling with a view toward experimental corroboration. This topic spans the areas of condensed matter physics, optics and photonics.

Research efforts in computational condensed matter physics (Medvedeva and Chernatinskiy) combine large-scale ab-initio calculations with analytic models to understand fundamental properties of advanced materials. **Dr. Julia Medvedeva** focuses on complex physics of transparent conducting oxides, amorphous oxide semiconductors and other systems. **Dr. Aleksandr Chernatinskiy** is interested in thermal and electronic properties of materials in extreme environments.

Our royal chief of operations, **Dr. Dan Waddill**, is the good soul who keeps the department together while acting as the all-encompassing department head and maintaining a research interest in the solid state of matter, notably surface science and spectroscopic properties of surface-layer atoms. **Dr. Alan Pringle** maintains a research interest in solid-state physics while winning acclaim as a Curators’ Teaching Professor, maintaining a high-profile undergraduate education at the University, for both physics as well as engineering students alike. **Dr. Paul Parris** investigates dynamical processes in condensed matter, using a variety of theoretical methods.

The solid state physics group cordially invites students who are interested in properties of advanced materials and exotic phases in condensed matter, to participate in various projects currently funded by the National Science Foundation.
Cloud and Atmospheric Physics: Dr. Don Hagen studies the emission characteristics of aircraft engines on site with a combination of sophisticated recording devices complemented by computer monitoring. He and colleague professor Phil Whitefield from the chemistry department were lead researchers that helped the Intergovernmental Panel on Climate Change (IPCC) win the 2007 Nobel Peace Prize. Dr. Barbara Hale studies cloud formation physics and has an interest in elementary particles.

Dr. Gerald Wilemski complements the research program with studies of complex systems, with a focus on thermodynamic properties. The cloud and atmospheric physics group can offer research opportunities in both fundamental science as well as industrial applications. Aircraft emission measurements often require students to travel abroad in order to carry out corresponding measurements, adding an element of excitement to a very interesting field of research.

Physics Education: Dr. Agnes Vojta’s courses regularly win the acclaim of physics and engineering students alike. Finally, David Lay has received acclaim for his efforts in undergraduate teaching, both within the physics department as well as in regard to bridges built toward the engineering community on campus. Adam Upshaw and Joel Peacher complement the teaching faculty of the department.

Missouri University of Science and Technology (formerly University of Missouri at Rolla, originating from the Missouri School of Mines) traditionally has a strong presence in the mining and engineering disciplines, and many graduates find work in the aerospace industry. The University offers advanced courses within the graduate engineering program for students wishing to broaden their knowledge in neighboring disciplines the include an overlap with civil and aerospace engineering. Graduate courses offered at the University range from general relativity to atomic physics, computational physics and classical electrodynamics, as well as elementary particles and the Standard Model.

The department cordially invites applications for entry into the physics undergraduate and graduate programs. For domestic applicants to the graduate program, Chancellor’s fellowships, and distinguished Chan-
Cellor’s fellowships are available. Inquiries are to be directed to the director of graduate admissions, Dr. Don Madison (email: madison@mst.edu), or to the head of the department of physics, Dr. Dan Waddill (email: waddill@mst.edu). Missouri S&T is an equal opportunity employer. Recent graduates of the department include Professor Dr. John A. Johnson (BSc 1999), who teaches at Harvard University, and Dr. Allison Harris, (PhD 2009), who is an Assistant Professor at Illinois State University, Dr. José Hoyos and Dr. Erik Lötstedt who worked in the department as postdocs (appointments in 2006 and 2012, respectively), now have Professorships at the Universities of São Paolo and Tokyo, respectively, and Dr. Rastko Sknepnek (PhD 2004) now is a faculty member at the University of Dundee, Scotland. Dr. Aaron Laforge (PhD 2010) is working in high-intensity laser physics at the University in Freiburg (Germany), toward an Assistant Professorship. Dr. Chris C. Polly (BSc 1996) is now heading the muon $g-2$ project at Fermilab. This project aims to measure a fundamental property of an elementary particle, namely, the anomalous magnetic moment of the muon, to advance our understanding of the fundamental forces of nature.