Alexander Gray earns prestigious Young Investigator award

Alexander Gray, a new assistant professor of physics, has received a prestigious Young Investigator Program award from the U.S. Army Research Office. Gray specializes in the development of new, ultrafast X-ray spectroscopic and imaging techniques. These techniques aim to understand how new phases of matter arise far from equilibrium and how ultrafast electric-field pulses can be used to separate and control fundamental physical interactions on the nanoscale.

A 2011 recipient of a PhD in physics from the University of California, Davis and the Lawrence Berkeley National Laboratory, Gray is an expert in bulk-sensitive and depth-resolved X-ray spectroscopic and imaging probes of electronic structure. During his graduate career he pioneered new X-ray techniques, such as hard X-ray angle-resolved photoelectron spectroscopy (HARPES) and standing-wave excited angle-resolved photoelectron spectroscopy (SW-ARPES).

These techniques have been successfully applied by Gray, collaborators and other researchers to bulk- and interface-sensitive studies of key materials in the field of spintronics, as well as to the interfaces of relevance to low-dimensional heterostructuring and energy-efficient field-effect devices. Previously Gray spent three years as an experimental research associate at the Institute for Materials and Energy Science at Stanford University, where he conducted research at the Department of Energy’s SLAC National Accelerator Laboratory.

To enhance student engagement, comprehension and success, the courses will be taught in two dedicated, high-tech classrooms. Labs will also be conducted in new SERC undergraduate teaching labs.

To develop the undergraduate program SERC is piloting at MIT, where Surrow previously taught and utilized the personal response systems-based conceptual questions, significantly as collaborative desktop experiments, web-based assignments and solving session discussions.

To the interfaces of relevance to low-dimension ultrafast X-ray spectroscopic and imaging probes of electronic structure, from Calttech; and John P. Perdew and Adriano Ruzicka, from Tulane University. Perdew is a leader in density functional theory and author of a top-selling book according to Thomson Reuters Web of Science database. And I joined Temple after 20 years at Renesselaer with a focus in experimental nuclear and particle physics.

Recent highlights also include:

- Our hosting a nuclear physics town meeting that attracted about 250 physicists from the US and around the world to help determine the direction of our country’s nuclear research.
- The designation of our Center for the Computational Design of Functional Layered Materials directed by Perdew as one of just a few new federal Energy Frontier Research Centers.
- The successful test and implementation of Rongli Tao’s technology to enhance the flow of crude oil through pipelines.
- To witness the exciting research and teaching that is occurring here, please visit us online at phys.cst.temple.edu or in person.

Jim Napolitano Interim Chair, Department of Physics

phys.cst.temple.edu

Message from the Chair

OUR DEPARTMENT’S MOVE LAST FALL INTO THE NEW SCIENCE EDUCATION AND RESEARCH CENTER (SERC) – and our ongoing recruitment of outstanding faculty members to maximize the building’s exceptional research and teaching resources – have dramatically heightened the department’s stature.

Hires to our growing faculty of 22 since 2012 include: Bernd Surrow, a high-energy collider researcher from MIT, Alexander Gray, a former material science Stanford University postdoctoral research associate; Darius Torchinsky, a quantum electronics researchers from Caltech; and John Perdew and Adriano Ruzicka, from Tulane University. Perdew is a leader in density functional theory and author of a top-selling book according to Thomson Reuters Web of Science database. And I joined Temple after 20 years at Renesselaer with a focus in experimental nuclear and particle physics.

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Device enhances oil pipeline flow

An electrical device designed by professor of physics Rongjia Tao, which enhances the flow of crude oil through pipelines, has been successfully field tested on portions of a major U.S. pipeline.

Tao’s oil technology device reduces the viscosity and turbulence of crude oil. Patented by Temple University, the device was created with the financial support of QSI Energy, Inc., a Santa Barbara, California-based developer and vendor of commercial flow assurance solutions.

Utilizing electrophoretic principles, Tao’s devices have been installed just downstream from pipeline pump stations. The electrical field polarizes suspended nanoparticles found in crude oil, causing them to aggregate in short chains along the flow direction—which both decreases viscosity in that direction and effectively suppressing turbulence. This green technology may eliminate the need to heat the crude oil, a current costly industry standard, while significantly reducing required pumping pressures.

Field tests have indicated viscosity decreases. “It also reduces the power needed to pump crude oil while the flow rate is unchanged,” added Tao. “And by reducing pumping pressures, it’s much safer for both land-based pipelines and pipelines that connect with offshore drilling sites.”

DEPARTMENT OF PHYSICS FUNDED RESEARCH

Department’s funded research portfolio continues to grow

ATOMIC, MOLECULAR AND OPTICAL PHYSICS

Marjatta Lyra and Ergih Ahmed
• Control of quantum state changes with bichromatic fields, NSF

Svetlana Kotobchouk
• Quantum magneto-optics of strongly correlated magnetic atoms and molecules, Air Force Office of Scientific Research (AFOSR)

• Controlling anisotropy in interactions of ultracold atoms and molecules for quantum information processing, NSF

• High-resolution quantum control of chemical reactions, MURI Army Research Office (ARO)

• Precision chemical sensing and quantum control of ultracold molecular ion reactions, MURI ARO

CONDENSED MATTER AND MATERIAL SCIENCE

Kef Chen (PI) and Xiaoning Xi
• Superconducting devices using magnetic diode Josephson junctions, Office of Naval Research (ONR)

Alexander Gray
• Controlling fundamental physical interactions in ultracold quantum few-body systems and two-dimensional electronic systems with ultrathin THz electric fields, ARO Young Investigator Program

Maria Lavenue
• Vortex-Matter in confined superconductors and mesoscopic hybrid heterostructures, NSF

• Manipulation of chiral charge density waves, ARO

John Perdew (director), Maria Lavenue, Adrienne Rusininsky, Rongjia Tao and Xiaoning Xi
• Energy Frontier Research Center: Center for the Computational Design of Functional Layered Materials, DOE

John Perdew
• Density functional theory of electronic structure, NSF

Adrienne Rusininsky
• Exploring the real space phase approximation for materials and chemical physics, DOE

Peter Rübenach
• Strongly correlated electron systems, DOE

Rongjia Tao
• Atom chips produced by various isotope, Naval Research Lab

• Research on rust oil viscosity reduction and diesel fuel injection, Save the World Alliance

• Magneto and electric field application to confectionary materials, Mars Chocolate, UK

Department of Physics welcomes back Professor Xiaoning Xi, offer an investigation by the U.S. Justice Department where all charges against him were dropped.


The Department of Physics presents new faculty. In the computer laboratory, a new website is online.

GARETT MILLER: UNDERGRADUATE RESEARCH IN PROTEIN FOLDING

Undergraduate Research Program (URP) student Garrett Miller, CST 16, a senior physics major and computer science minor, was uncertain whether he wanted to go to graduate school and, if he did, was not sure if he wanted to go into astrophysics or biophysics—until he began working with Vincent Voelz, assistant professor of chemistry.

He focused on protein folding, a process fundamental to such mental illnesses as Alzheimer’s and mad-cow disease. In nature, such proteins fold in a microsecond, but to simulate that process it was taking Miller 240 hours’ worth of time on the university’s high-performance supercomputer.

“One was a question about continuing my education, but this summer was pretty successful so I feel secure about going to grad school for biophysics,” he says. “When you’re doing a lab assignment it’s always a homework assignment, but in this lab what I am doing has direct implications for people who have those diseases, at least that’s the goal.”

Launch in 2009, URP enables undergraduates to obtain valuable hands-on research experience with world-class researchers. Since then, 750 CST students have participated in the highly selective project.

Support undergraduate research

CST’s Undergraduate Research Program (URP) offers motivated students the opportunity to work with world-class researchers on real-world research. More than 750 students have participated, gaining a valuable advantage in the job market and competitive graduate programs.

To make a gift, contact John Walker at 215-204-8176 or john.walker@temple.edu or go to giving.temple.edu/urp

DEPARTMENT OF PHYSICS 2015 AWARDS

STUDENTS

Distinguished Graduate Student Research Award: Steven Moore

Distinguished Graduate Student Teaching Award: Xiangyen Deng

Peter Havas Humanitarian Scholarship for Outstanding Graduate Physics Student: Adam Blooming

Alliance for Minority Participation Award for Academic Achievement: Gregory Bull

Alliance for Minority Participation Award for Research: Brandon Elman

Robert and Rita Cook Science Scholars Award: Jeffrey Timlin

Seda Tariyan Endowed Scholarship: Melissa Rehhuis

The College of Science and Technology Student Advisor Award: John Rostron

Undergraduate Research Program Summer-Fellow: Jeff Stanford

Dr. Paul G. & Beatrice Zacks Physics Scholarship: Dillon Fox

Murray Green Memorial Prize in Physics: Ibran Elman; Brandon Elman; 2015; Dillon Fox

Donald and Annette Baird Family Award in Science and Math Education: Catherine Bergeron

FACULTY

Young Investigator Award, U.S. Army Research Office: Alexander Giny

Honorary degree, Budapest University of Technology and Economics: John P. Perdu

Humboldt Research Award: John P. Perdew

John Scott Award: John P. Perdew

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