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Summer 2009

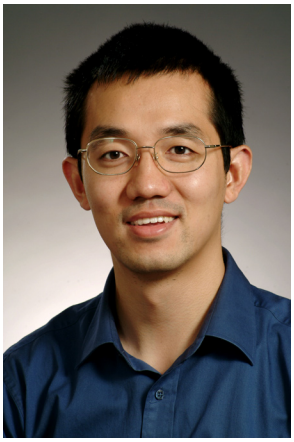
Electrical & Computer Engineering

Two Junior Faculty Members Receive NSF CAREER Award

Assistant Professors Jing Guo and Tao Li, received the National Science Foundation (NSF) Faculty Early Career Development (CAREER) award.

The Career program is the NSF's most prestigious award for new faculty members, designed to recognize and support the early career-development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century.

Dr. Jing Guo received the CAREER award for his proposal "QMHP: A Multiphenomena Simulator toward New Functionalities of All-Graphene Devices".



This NSF Career proposal focuses on the development of multiphenomena device physics of a patterned graphene to a point where new classes of devices can be conceived and simulated. The research would enable engineering graphene for integration of communication, data storage, and imaging functionalities into existing integrated circuit technologies, and thus significantly extend the chip capacity through functional diversification.

A team of scientists and engineers from Stanford University, the University of Florida and Lawrence Livermore National Laboratory is the first to create one of two basic types of semiconductors using an exotic, new, one-atom-thick material called graphene.

The findings could help open the door to computer chips that are not only smaller and hold more memory — but are also more adept at uploading large files, downloading movies, and other data and communication intensive tasks.

"There are still enormous challenges to really put it into products, but I think this really could play an important role," said Guo. "

The team made, modeled and tested what is known in the industry as an "n-type" transistor out of graphene nanoribbon. Graphene is a form of carbon that has been called "atomic chicken wire," thanks to its honeycomb-like structure of interconnected hexagons. A graphene nanoribbon is a nanometer-wide strip cut from a graphene layer.

The team's feat is significant because basic transistors come in only two forms — "p-type" and "n-type" — referring to the presence of holes and electrons, respectively. "P-type" graphene semiconductors had already been achieved, so the manufacture of an "n-type" graphene semiconductor completes the fundamental building blocks.

This work is essentially finding a new way to modify a graphene nanoribbon to make it able to conduct electrons," Guo said. "This addresses a very fundamental requirement for graphene to be useful in the production of electronics."

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Guo said the team built and modeled the first-ever graphene nanoribbon n-type "field-effect transistor" using a new and novel method that involves affixing nitrogen atoms to the edge of the nanoribbon. The method also has the potential to make the edges of the nanometer-wide ribbon smoother, which is a key factor to make the transistor faster.

"This uses chemistry to really address the major challenges of electrical engineering when you get into these small nanoscale dimensionalities," he said. "It is very unusual for electrical engineers, who are used to dealing with bulk structures of at least millions of atoms."

As exciting as the findings are, researchers must overcome many challenges before graphene semiconductors could be manufactured in bulk for use in consumer products, Guo said. For one thing, graphene is extremely expensive, so its cost would have to be reduced substantially. Also, to mimic or exceed silicon, engineers would have to determine how to build not just one, but billions of transistors, on a tiny graphene fleck.

Guo joined the faculty in 2004. He received his doctoral degree from Purdue University in 2004. His current research focuses on modeling and simulation of nanoelectronic devices, carbon nanotube electronics and photonics, physics of nanotransistors, computational nanobiotechnology.

Dr. Tao Li received his CAREER award for his proposal "New Foundations for Many-core Architecture Analysis, Modeling and Management".

This NSF Career proposal focuses on constructing new foundations for many-core scale architecture analysis, modeling and optimization, including: (1) informative and scalable methods to capture architectural characteristics across many-cores and hardware components; (2) fast and accurate predictive models to forecast the complex behavior of many-core architecture substrates with widely varied configuration parameters and execution conditions; (3) hardware and software mechanisms for efficient mining of architecture characteristics at large scales; and (4) global and cooperative resource and thermal management techniques for many-core architectures. A unified framework integrating the above analysis methods, models and software/ hardware support will be developed in this project.

Li also joined the faculty in 2004. He received his degree from the University of Texas at Austin. His research interests include computer and digital system architecture; interaction of computer architecture, emerging applications, operating systems, programming language features, managed run-time environments; modeling, simulation and evaluation of computer systems.

In Memoriam
Dr. Jack R. Smith

Jack Reginald Smith, PhD, P.E., 73, died on Thursday, June 11, 2009, at Shands Hospital from complications of pulmonary fibrosis.

Dr. Smith was a professor of electrical engineering at the University of Florida for 30 years and an entrepreneur, founding two companies that developed software for automated sleep analysis.

Born in North Dakota on June 16, 1935, he was the son of Henry R. Smith and Laura Kornkven. He spent his youth in Minnesota and moved to Los Angeles in his teens. He attended Menlo College prior to enlisting in the army in 1953. He was honorably discharged and completed his BS, MS, and PhD in electrical engineering at the University of Southern California.

After working in both the space and military industries, Dr. Smith joined the Electrical Engineering Department of the University of Florida as an assistant professor in 1964, electing to work in the biomedical engineering field. At the university, Dr. Smith worked with Dr. Wilse Webb and Dr. Ismet Karajan to develop quantitative techniques for sleep analysis. He also worked with UCLA's Space Biology laboratory and spent the academic year 1970-71 in Cassis, France, collaborating with researchers at the University of Marseille.

Dr. Smith spent two more academic sabbaticals helping develop sleep instrumentation: in 1978 with the late Jean-Michel Gaillard at the Medical School of Geneva, Switzerland, and in 1985 with Japanese colleagues at the Tokyo Metropolitan Research Institute. His textbook, Modern Communication Circuits, is in its second edition and is still widely used. In 1986, Dr. Smith started Microtronics, Inc., developing sleep analyzing computers. He sold Microtronics to Oxford Medical in 1990.

After the sale of Microtronics, he returned to the University of Florida until he retired as professor emeritus in 1994. He also served as a consultant to Motorola in Plantation, Florida.

After his retirement from UF, he developed another sleep analyzing system, the Polysmith, with his company Neurotronics. Neurotronics was sold to the Japanese company Nihon Kohden in December 2008 but Dr. Smith remained as Chairman of Neurotronics, Inc.

Dr. Smith's interests were many and varied. He was the amateur chess champion of Florida in 1968; he enjoyed handball; and poker remained a part of his life until a few weeks before he passed away. His love of fishing, cultures and his business led him to many other countries. He enjoyed growing orchids, enticing birds to his many birdhouses, and boating on the lake with his chocolate labrador retrievers. He was a supporter of the arts as well as conservation and environmental organizations, and he was an advocate for the homeless. He read widely and voraciously.

The family has requested that expressions of sympathy may be made as donations to Habitat for Humanity, The Salvation Army, the Harn Museum, or a charity of your choice.

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216 Larsen Hall
P. O. Box 116200
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