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News

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NSF Grant Supports Graphene Nanoelectronics Research

The National Science Foundation (NSF) has awarded a research grant to Dr. Eui-Hyeok (http://www.stevens.edu/research/Eui-Hyeok-Yang/rid/120) (EH) Yang, Associate Professor of Mechanical Engineering (/ses/me/) at Stevens Institute of Technology, to study the properties of graphene nanoribbons for use in infrared (IR) detection. Assistant Professor Stefan Strauf (http://www.stevens.edu/research/research_profile.php?fac_id=456) of the Department of Physics and Engineering Physics (/ses/physics/) is the co-PI of this grant. This funded research is to investigate the properties of actively controlled graphene nanoribbon arrays that researchers can "tune" for use in IR detectors covering an ultra-wide spectral range.

"This NSF grant recognizes the role that Stevens is playing in developing an understanding of how to harness graphene's potential," says Dr. Constantin Chassapis (http://www.stevens.edu/research/Constantin-Chassapis/rid/76), Department Director of Mechanical Engineering and Deputy Dean of the School of Engineering and Science (/ses/). "Researchers at the University are getting excellent results and publish in high profile journals in this booming area of study."

The first scientific isolation of graphene, published in Science in 2004, won its discoverers the Nobel Prize in 2010 and has driven exploration and innovation around the world. A monolayer of carbon atoms with intriguing properties, graphene is strong and dense, yet lightweight and transparent. As a conductor of electricity, it performs as well as copper, and it conducts heat better than any other known material. Furthermore, the strong bonds of carbon atoms result in nearly flawless structures, over which electrons exhibit peculiar behaviors that scientists can exploit.

In their awarded research, Dr. Yang and Dr. Strauf investigate nanoelectromechanical devices employing graphene nanoribbons to significantly improve IR detection schemes. Current IR detectors experience both limitations in their spectral range, for those that rely on the fixed IR absorption properties of detector materials, or their general sensitivities, in the case of tunable thermal detectors. The proposed concept offers the unique possibility of achieving high sensitivity across a wide spectral range with a single detection system.

"This work is research at the forefront of physics and has tremendous potential for a broad range of next-generation electronic and optical applications," says Dr. Rainer Martini (http://www.stevens.edu/research/Rainer-Martini/rid/439), Department Director for Physics and Engineering Physics. Developing IR detection has important applications in imaging, remote sensing, surveillance, and spectroscopy, but the research team's work will also enable a wide range of other photonic applications. These include high speed optical communications, free-space optical communication in foggy environments, interconnects, and terahertz detection, all using graphene nanoribbon devices.

Educational initiatives connected with this NSF grant will provide training for students in the Nanotechnology Graduate Program (http://www.stevens.edu/nano/), as well as other opportunities for graduate and undergraduate students. Additionally, a partnership with Stevens Center for Innovation in Science and Engineering Education (http://www.ciese.org/)will promote knowledge and interest in

nanotechnology and careers in science and engineering to K-12 students, especially in underrepresented communities. Dr. Yang and Dr. Strauf also mentor Stevens graduate students in the NJ Alliance for Engineering Education (http://www.stevens.edu/njaee/)program to develop hands-on teaching modules that engage high school students with exciting learning activities and encourage them to aspire to college education in the STEM fields.

Dr. EH Yang

As director of the Nanoelectronics Laboratory (http://www.stevens.edu/nanoelectronics/), Dr. Yang's research focuses on utilizing engineered low-dimensional carbon materials and nanostructures for realizing nanosensors/actuators and nanoelectronics/optoelectronics devices. His work has received grants from AFOSR, NASA, and NSF. He is the recent recipient of an NSF MRI grant (http://buzz.stevens.edu/index.php/yang-nil) for a nanoimprint lithography system and DURIP grant (http://buzz.stevens.edu/index.php/yang-durip-2011) for a high-resolution scanning probe microscope. Dr. Yang is also the director of multi-user Micro Device Laboratory (http://www.stevens.edu/mdl/) (MDL).

Dr. Stefan Strauf

Dr. Strauf is director of the NanoPhotonics Laboratory (http://www.stevens.edu/nanophotonics/) at Stevens, with a research focus on nanophotonics and nanoelectronics. He has particular interest in nanostructured devices scaled down to the ultimate quantum limit where one can control and manipulate individual electrons, excitons, or photons. In 2008 he received the Harvey N. Davies Memorial Award for Research Excellence from Stevens. Earlier this year he was awarded as a Lange Lecturer from UC Santa Barbara and he received the NSF CAREER Award (http://buzz.stevens.edu/index.php/strauf-nsf-career-award) to address the problem of scalability of semiconductor quantum photonic devices.

Visit Mechanical Engineering (/ses/me/), Physics and Engineering Physics (/ses/physics/), or the Nanotechnology Graduate Program (http://www.stevens.edu/nano/) for more information about research at the nanoscale at Stevens.

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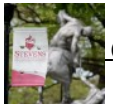
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1 Castle Point Terrace

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201.216.5000 (tel:+12012165000)