Workshop on Graphene Nanotechnology

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Abstract: Graphene is a two-dimensional single-atom thick membrane of carbon atoms arranged in a honeycomb crystal. It is a perfect example of a two-dimensional electron system for a physicist, an elegant form of a two-dimensional organic macromolecule consisting of benzene rings for a chemist, and a material with immense possibilities for an engineer due to its excellent electrical, magnetic, thermal, optical and mechanical properties. In this workshop, we will focus on the metrology, synthesis, electronic structure, transport properties and various device applications of graphene. Within each topic, we will make progression from the basics to the advanced concepts.

Bio: Hassan Raza is an Assistant Professor in Electrical and Computer Engineering at the University of Iowa since May 2009. For two years, he was a postdoctoral associate at Cornell University. He received his PhD May-2007 and MS Dec-2002 from Purdue University; and BS July-2001 from the University of Engineering and Technology Lahore Pakistan. He has received “Magoon Award for Excellence in Teaching” from Purdue University. He is also the recipient of “Presidential Faculty Fellowship” from the University of Iowa. His research group is focused on “anything that is small” for low-power post-CMOS transistor, spintronics and solid-state energy-harvesting applications from theoretical, experimental and computational approaches using graphene, molecule, silicon, novel dielectrics and carbon nanotube material systems. He is also serving as the editor of a book on Graphene Nanoelectronics to be published by Springer in 2011.

Pre-requisites: There are essentially no course pre-requisites. An in-progress of completed degree in electrical engineering, physics or chemistry will be helpful. Familiarity with MATLAB is a pre-requisite.

Duration: Workshop is Monday through Thursday (Dec. 27, 2010 – Jan. 14, 2011). Each day, a lecture (2-4pm) will be followed by a MATLAB-based computer lab for about an hour.

Topics: A preliminary list of topics is as follows:

- Introduction to Graphene NanoScience and Technology (1 Lecture)
- Atomic Structure of Graphene and its various Nanostructures (1 Lecture)
- Electronic Structure of Graphene and Bilayer Graphene (2 Lecture)
- Electronic Structure of Graphene Nanoribbons (1 Lecture)
- Electronic Structure of Carbon Nanotubes (1 Lecture)
- Quantum Transport in Nanoribbons, Nanotubes, and Graphene (2 Lecture)
- Applications in Electronics, Photonics, Plasmonics, Energy-harvesting (1 Lecture)
- Metrology using Spectroscopy and Microscopy (1 Lecture)
- Synthesis using “Schotch Tape”, Chemical Vapor Deposition, SiC-based (1 Lecture)