055:191

Electrical & Computer Engineering Graduate Seminar

SPEAKER: Hassan Raza

"Non-equilibrium phenomenon at the nanoscale for novel electronic devices"

Thursday September 3, 2009 3:30-4:20 PM Room 3321 SC

Abstract

Coherent control of materials at the atomic scale under non-equilibrium conditions could lead to room temperature quantum devices. Consistency between theory, experiments, computation and spectroscopy is the key to achieve this objective. In this talk, I will start the discussion with a generic atomistic incoherent transport model based on extended Hückel theory (EHT) for electronic-structure, nonequilibrium Green's function formalism (NEGF) for quantum transport, self-consistent Born approximation (SCBA) for scattering and complete neglect of differential overlap (CNDO) for Hartree potential with 3D electrostatics and image potential corrections. To start-with, field-modulation in armchair graphene nanoribbons and molecules would be addressed. Inspired by the work on molecules and graphene, a new transistor concept, named Electronic-structure Modulation Transistor (EMT), is proposed based on the modulation of the bandwidth of a midgap or a near-midgap state. Theoretical analysis of the functionality of the EMT would be presented, using a single-band tight-binding theory, to confirm if an EMT has a gain and if it can overcome the *2.3kT/decade* thermal limit. Preliminary experimental efforts geared towards the proposed mechanism, although still not a working prototype, would be presented using a 20 nm nitride/Au nanocrystals (NC) composite channel.

Bio

Hassan Raza received his BS 2001 from University of Engineering and Technology Lahore Pakistan majoring in electronics and communication and his MSECE from Purdue University in 2002. Starting May 2007, he joined Professor Edwin Kan's group at Cornell University Ithaca NY as a postdoctoral associate, where he invented the use of electronic-structure modulation for low-power transistor. In May 2009, he moved to the University of Iowa to start a theoretical and experimental group for solid-state energy-harvesting research and low-power post-CMOS transistor. His research focus is in quantum transport, electronic structure and energy-conversion phenomenon in nanoscale devices from theoretical, experimental and computational approaches. He works with graphene, molecule, silicon and carbon nanotube material systems.

All ECE graduate students are required to attend.

For more information contact:

Professor Hassan Raza 384-1879, hraza@engineering.uiowa.edu