Yale Institute for Nanoscience and Quantum Engineering

Friday- Nov. 2, 2012

12:00 to 1:00 p.m.

Becton Seminar Room

Light lunch will be served at 11:45 a.m.

Xiaokai Li

Department of Chemical & Environmental Engineering, Yale University

"Hybrid solar cells for cost effective energy conversion"

Solar cells based on crystalline silicon (Si) offer high efficiency but they are expensive partially because they require ultra-clean furnaces, pure precursors and high temperatures. The alternative approach using low-temperature processable organic-semiconductors is potentially cheaper, but organic solar cells are not very efficient. Here, we explore if single walled carbon nanotubes (SWNTs) can be integrated with Si to form hybrid SWNT/Si solar cells that are both efficient and low-cost. We have developed two scalable solution processes for fabricating SWNT thin films that are not only highly transparent and conductive, but also mechanically robust and morphologically smooth. Room temperature deposition of as-made SWNT thin films on Si results in SWNT/Si hybrid solar cells. The key design rules and post-processing to achieve higher power conversion efficiencies are discussed and experimentally demonstrated. Using the prescribed design rules and post-processing, SWNT/Si hybrid solar cells with a fill factor of 73.8%, ideality factor of 1.08 as well as overall dry cell power conversion efficiency of 11.5% are demonstrated.

Ioan Pop

Yale University School of Arts and Science, Applied Physics

"Superinductances for Quantum Electronics"

Superconducting circuits using networks of Josephson junctions implement on chip artificial atoms and molecules with custom designed Hamiltonians. Direct applications include the implementation of quantum circuits topologically protected against decoherence or the design of frequency-to-current conversion devices. This emerging field of quantum electronics is challenged by the engineering of an electromagnetic component which suppresses simultaneously the quantum fluctuations of charge and the ever present low-frequency charge noise. We present the successful implementation of such a component, nicknamed "superinductance"

HOST: Mark Reed