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Title: Performance, Design, and Modeling of Bio-Assembled Carbon Nanotube FETs and RTDs
Speaker: Professor Roger Lake (University of California, Riverside)
Date: Thursday, June 15th
Time: 11:00 AM Pacific, 2:00 PM Eastern

ABSTRACT

Functionalized, self-assembled carbon nanotubes are discussed in relation to electronic devices, circuits, and architectures. CNTFET on insulator designs will be described that exhibit high performance, that exhibit Coulomb blockade of the ambipolar leakage current, and that meet the requirements imposed by a bio-self-assembly process. The performance is characterized by the metrics of inverse subthreshold slope, on-off current ratio, delay time, and cutoff frequency.

While most current work has focused on CNTs used for field effect transistors, CNTs connected by molecular linkers can act electronically as resonant tunneling diodes (RTDs). The addition of RTDs to transistor circuitry allows for greater functionality with fewer devices. The greatest advantage of this for self-assembly is simplified circuit topology. Resonant tunneling operation is demonstrated both theoretically and experimentally for CNT-L-R-L-CNT systems in which L is the amide linker and R is either C₂H₄ or single strand DNA.

The computational approach uses density functional theory coupled with non-equilibrium Green function theory for modeling device electrical properties. If time permits, the application of this approach to the modeling of Si nanowires will be described.

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