

University of California, Davis
Physics Department
Condensed Matter



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"Nanoscale Superconductivity and Electronic"

It has proven to be fascinating and rewarding to investigate and exploit properties of nanoscale systems, such as carbon nanotubes, nanowires and molecules. The first part of my talk will focus superconductivity in ultrathin nanowires. We demonstrated that superconductivity is suppressed by the macroscopic quantum tunneling of the phase of the superconducting order parameter, and the residual resistance depends exponentially on the wire diameter. This work establishes a limit to the miniaturization of superconducting electronics, and may have important implications for quantum computing based on superconductors.

The second part of my talk focuses on electrical transport in molecular devices. In particular, conductance switching in metal/molecule/metal structures has received much attention because of their potential use as nano-scale memory elements. However, the switching mechanism remains controversial. By using atomic force microscope (AFM) to apply a localized force to the junction while monitoring device conductance, we observe nanoscale conductance peaks in response to applied pressure, indicating nanoscale conductance channels through the devices. Additionally, for devices with conductance of ~ 1 to 2 conductance quantum, we also observe conductance dips and oscillations under localized pressure. The results are consistent with quantum interference of electrons between partially transmitting electrodes.

Thursday, May 4, 2006
4:10pm, Room 416 Phy/Geo