THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

COLLOQUIUM

Oxide Nanoelectronics on Demand

by

Dr. Cheng CEN (岑誠博士)
Department of Physics and Astronomy
University of Pittsburgh, USA

Date: February 11, 2011 (Friday)
Time: 4:00 - 5:00 p.m.
Place: L2, Science Centre, CUHK

(Light refreshments will be served 20 minutes prior to the colloquium.)

ALL INTERESTED ARE WELCOME
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Abstract

Control over electronic confinement in the solid state is increasingly challenging as the dimensionality and size scale are reduced. By scanning a biased conducting atomic force microscope (AFM) tip along a programmed trajectory at room temperature, we can reversibly control in nanoscale the metal-insulator transition at the interface of an oxide heterostructure formed from LaAlO3 and SrTiO3. Positive tip voltages produce conducting regions at LaAlO3/SrTiO3 interface directly below the area of contact, through a process analogous to modulation doping. Negative tip voltages restore the area back to insulating state.

Using the technique described above, a variety of rewritable nanosize devices and structures have been studied. These nanoelectronic components are mainly assembled from basic elements including conductive wires and dots whose characteristic dimensions are just a few nanometers. Among the most interesting devices is a sketch-based transistor (SketchFET). Besides the conventional field effect mode, SketchFET can also function in a field-emission mode where it is sensitive to electronic properties changes in surrounding materials. Switching speeds exceeding GHz barrier have been demonstrated. Other examples include in-plane rectifying junctions and field-tunable nanoscale photodetectors. At low temperatures, a variety of electronic, spintronic and superconducting properties are observed, with enormous potential for exploitation in quantum devices.

Enquiries: 2609 6339