Yale Institute for Nanoscience and Quantum Engineering

Friday- April 17, 2015

12:00 to 1:00 p.m.

BECTON SEMINAR ROOM

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

Sylvia Xin Li

Department of Physics, Yale University

"Divalent Charge Inversion and ion Transport in Nanochannels"

Solid-state nanofluidic devices have proven to be ideal systems to elucidate the physics of nanoscale ion transport. When the device confinement approaches the Debye length of ions in the fluid, new phenomena occur such as surface-charge-dominated transport and ion-selectivity. Although these effects have been understood for simple monovalent systems, application-critical divalent systems have not been sufficiently studied, which are essential in biological systems. We explore for the first time divalent nanofluidic devices, and observe striking differences including charge inversion at the solid/fluid interface. This counter-intuitive over-screening effect plays a critical role in DNA condensation and colloidal coagulation. We have performed a systematic study to explore the divalent ion-surface interactions and ionic transport at nanoscale, which lies at the heart of interdisciplinary research such as biophysics, colloidal science and energy storage and conversion.

Ankit Disa

Department of Applied Physics, Yale University

"Manipulating Electronic Structure and transport in Complex Oxide Heterostructures"

Complex oxides are a fascinating class of materials that exhibit the full spectrum of physical phenomena: superconductivity, magnetism, quantum phase transitions, and more. Moreover, the correlated interplay between structural, charge, spin, and orbital degrees of freedom in these systems opens up the possibility of inducing and controlling exotic phenomena using state-of-the-art atomic layering techniques. In this talk, I describe the engineering of electronic structure and transport properties of complex oxides. Specifically, I focus on our ability to manipulate the orbital configuration in rare-earth nickelates with atomically-precise heterostructures using molecular beam epitaxy. A combination of first-principles theory and synchrotron-based x-ray techniques reveal that unique three-component heterostructuring can be used to effectively change the nickelate orbital structure to emulate that of the high-temperature superconducting cuprates, and, in fact, can tune the orbital configuration between the bulk structures. The approach is based on simple physical mechanisms and represents a potential route to explore and enhance a wide variety of orbitally-dependent phenomena including metal-insulator transitions, spin switching and superconductivity.