

Chez Pierre

Presents ...

Wednesday, March 7, 2012

12:00pm

MIT Room 4-331



SPECIAL CHEZ PIERRE SEMINAR

Keji Lai
Stanford University

"Probing Nanoscale Electronic Phases in Quantum Materials"

Complex quantum materials are characterized by their exotic phase diagrams, emergent physical phenomena, extreme electromagnetic properties, and enormous application potentials. In order to study the novel electronic phases inherently present in these systems, we have developed a scanning probe microscope to resolve the local dielectric constant and conductivity at 1GHz down to the sub-100nm length scale. In the first experiment, the metal-insulator transition in a strained colossal magnetoresistive manganite thin film was microscopically investigated. The magnetic-field induced orientation-ordered percolation network indicates that the substrate strain effect plays the dominant role in the phase separation [1]. In the second experiment, alternating metallic and insulating edge strips of a two-dimensional electron gas in the quantum Hall regime were spatially mapped out. The sizes, positions, and field dependence of the edge states agree quantitatively with the self-consistent electrostatic picture [2]. Continuous research effort is expected to impact many areas of condensed matter physics, including multiferroics, topological insulators, and metamaterials.

[1] K. Lai et al., Science 329, 190 (2010).

[2] K. Lai et al., Phys. Rev. Lett. 107, 176809 (2011).