

Chez Pierre

Presents ...

Monday, September 11, 2017

12:00pm Noon

MIT Room 4-331

Chez Pierre Seminar

Keji Lai - University of Texas, Austin

“Probing Microwave Dynamics in Ferroelectric Domains and Domain Walls”

Conventional dielectric spectroscopy experiments study the dynamics of ions, dipoles, atoms, and electrons in bulk materials. Using a broadband (from 1 MHz to 10 GHz) scanning impedance microscope, we show that the low-energy dynamic response to external stimuli can now be spatially resolved down to the mesoscopic length scale. In hexagonal rare-earth manganites, the dissipation of electrical energy on certain ferroelectric domain walls (DWs) is substantially enhanced at microwave frequencies than that at DC. First-principles and model calculations indicate that the effect is associated with a localized vibrational mode, i.e., the periodic DW sliding around its equilibrium position. In addition to the DW oscillation, the local electromechanical energy transduction in ferroelectric domain structures can also be visualized by the impedance microscopy. The interference-like patterns vividly demonstrate the spatial variation of surface-acoustic-wave generation, which can be understood by finite-element modeling of the energy transduction. Our work opens up a new frontier to explore various acousto-electric phenomena in complex materials and novel devices by nanoscale electromagnetic imaging.

