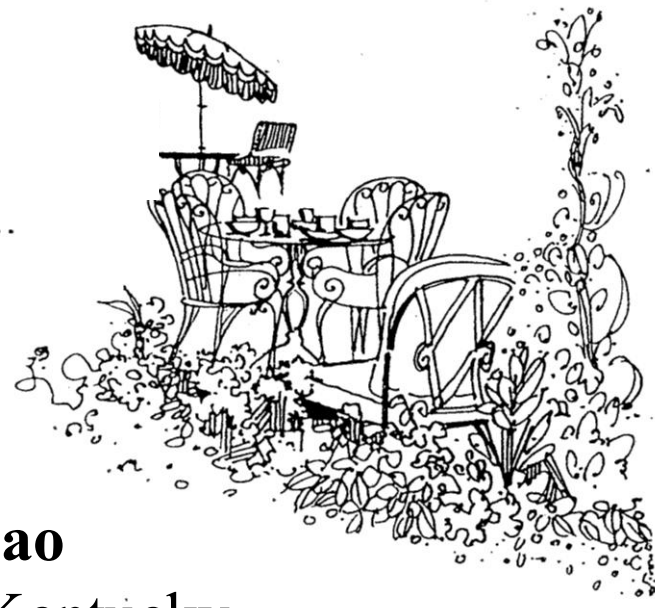
Chez Pierre

Presents ...

Monday, November 15, 2010
12:00pm
MIT Room 4-331



Gang Cao

University of Kentucky

"New Paradigms for Spintronics in Complex Oxides"

The 4d- and 5d-transition metal oxides exhibit nearly every collective state known for solids. It is commonly expected that 4d-based ruthenates and 5d-based iridates are more metallic and less magnetic than their 3d and 4f counterparts because the extended nature of orbitals leads to a broad 4d- and 5d-bandwidth and a reduced Coulomb interaction such that the Stoner criterion anticipates a metallic, paramagnetic state. In marked contrast, many layered ruthenates and iridates are magnetic insulators with a wide array of exotic properties. This talk reviews underlying properties of these layered materials with an emphasis on a few intriguing issues: (1) an unusual colossal magnetoresistance and a strong spin-valve effect existing in bulk single crystals of bilayered Ca3Ru2O7 [1-3], and (2) a novel Jeff = ½ Mott insulator, Sr2IrO4, and its unstable ground state that readily swings between highly insulating and metallic state via only slight perturbations [4-7]. These novel phenomena underscore a decisive role of spin-orbit coupling that rigorously competes with other energies, thus setting a new balance between various degrees of freedom in this class of materials.

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