LSU LOUISIANA STATE UNIVERSITY

PHYSICS & ASTRONOMY
WEEKLY CALENDAR

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Louisiana State University
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WEEKLY CALENDAR

April 16-20, 2012

DEPARTMENTAL COLLOQUIUM

"The effect of a single atom on high-Tc superconductivity"

3:40 PM, April 19, 2012
109 Nicholson Hall

Jenny Hoffman
Harvard University

Host: Ilya Vekhter

• Refreshments served at 3:15 PM in 232 (Library) Nicholson Hall •

Although superconductors recently celebrated their 100th 'birthday', these fascinating materials have yet to be fully understood or tamed for widespread application. High-Tc cuprate superconductors display startling nanoscale disorder in essential properties such as Fermi surface and superconducting critical temperature. However, the underlying cause of this disorder remains mysterious: does it arise from spontaneous electronic phase separation which is unavoidable, or from atomic scale chemistry which may be subject to our control? The highest Tc superconductors to date are all non-stoichiometric materials, but atomic scale chemical mapping has remained elusive. We extend the energy range of scanning tunneling spectroscopy, allowing the first-ever direct mapping of all three types of oxygen dopants in Bi2+ySr2-yCaCu2O8+x with maximum superconducting Tc ~ 90K. We show that a subset of these dopants are indeed the direct cause of the nanoscale disorder. We explain how the spatial variations in competing electronic orders, such as the notorious 'pseudogap' and the charge density wave, are governed by the disorder in the dopant concentrations, which suggests a possible avenue to raise Tc in this material.

Special Seminar

"Study of Quantum Thin Films: Phase Relationship in Pb/Si(111) and Successful Growth of Atomically Smooth Epitaxial Silver Film"

Monday, April 16, 2012 at 2:00 PM
262 Nicholson Hall

Jisun Kim
University of Texas at Austin
Host: Ward Plummer

Due to quantum confinement between the vacuum-solid and the solid-solid interfaces, distinctive quantum well states (QWS) form in metallic quantum thin films grown on semiconductor substrates. This results in physical phenomena occurring in a thin metal system which are totally different from the corresponding bulk system. Quantum thin film studies based on the Pb/Si(111) and Ag/Si(111) systems were performed utilizing low-temperature scanning tunneling microscopy/spectroscopy (STM/STS). The Pb/Si(111) system is chosen due to the unique phase matching between the Fermi wavelength and the lattice spacing along [111], leading to a bi-layer quantum oscillation in many physical properties including the surface energy and the work function. Surprisingly, STM/STS measurement has revealed that quantum oscillations of work function and surface energy have identical phase, in contrast to a theoretically predicted 1/4 wavelength phase shift in the phase relationship. Furthermore, a Ag growth procedure using molecular beam epitaxy (MBE) has been developed which enables the fabrication of epitaxial Ag films on Si(111) substrates with any desired thickness while maintaining atomic scale smoothness of the final surface. Its utility for plasmonics applications is also demonstrated.

Condensed Matter Seminar

"Spin-lattice coupling effects in the iron based superconductors"

Tuesday 4/17/12 at 3:40 PM
435 Nicholson Hall

Indranil Paul
Institute Neel, Grenoble, France
Host: Ilya Vekhter

The newly discovered iron based superconductors with unusually high transition temperatures exhibit a rich phase diagram that includes structural, magnetic and superconducting transitions. As such these materials are the latest playgrounds to study how in complex materials different phases compete, and how this unconventional setting eventually gives rise to superconductivity. The first part of the talk will be a review of this topic. From a theoretical point of view one of the goals at present is to identify the microscopic interactions that give rise to the rich phase diagram. This is the motivation to present in the second part of the talk a study of the effects of magneto-elastic couplings between the magnetic and the lattice degrees of freedom. We will argue that several unusual magneto-structural features of these materials can be understood from this point of view.