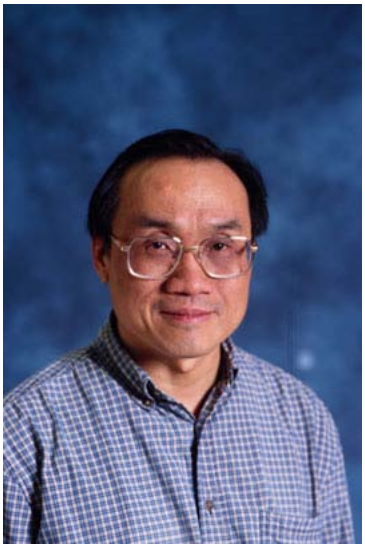
T_cSAM Bi-Weekly Brown Bag Seminar

Texas Center for Superconductivity and Advanced Materials



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"Intrinsic Electronic Instabilities, Magic Doping Levels, Wigner Lattices and High Temperature Superconductivity in Electrochemically Prepared $La_{2x}Sr_xCuO_{4+\delta}$"

Friday, June 27, 2003

University of Houston Science Center
Room 102
12:00 p.m. – 1:00 p.m.

Abstract

We present a systematic study of the super-oxygenated $La_{2-x}Sr_xCuO_{4+\delta}$ system. We show (i) that around room temperature, there are energetically favored intrinsic electronic instabilities of doped holes occur at some magic doping levels $p = 1/N^2$ where p is the number of holes per copper atom and N = 2, 3, 4… in the CuO_2 plane, (ii) that at low temperature, there are only two intrinsic T_c's, T_c ~15K and T_c ~ 30K, in the under-doped $La_{2-x}Sr_xCuO_{4+\delta}$. We argue that these instabilities are the manifestations of 2D electronic Wigner lattices and further show that they are intimately related to the occurrences of the intrinsic T_c ~15K and T_c ~ 30K superconducting transitions in $La_{2-x}Sr_xCuO_4$ single crystals. Based on (i), (ii) and our detailed studies of the far-infrared charge dynamics focusing on samples near N = 4, we find that only a very small (< 1 %) amount of the total holes participated in the nearly dissipationless normal state charge transport and superconductivity. These free carriers are riding on and massively screened by the rest of the holes organized in 2D Wigner lattice state. This unique composite system of charge carriers provides further insights into the understanding of the cuprate physics.

Persons with disabilities who require special accommodations in attending this lecture should call (713) 743-8210 as soon as possible.