

T_CSUH Bi-Weekly Seminar

Texas Center for Superconductivity at the University of Houston



Dr. T. K. Lee

Director, Institute of Physics

Academia Sinica

Taipei, Taiwan

Host: Dr. C. S. Ting

Monday, December 19, 2016

Room 102, University of Houston Science Center

12:00 noon – 1:00 p.m.

Spectra of intertwined-order states originated from Mott physics

ABSTRACT

Wei-Lin Tu^{1,2}, Peayush Choubey³, P. J. Chen², P. J. Hirschfeld³, Ting-Kuo Lee²

¹Department of Physics, National Taiwan University, Daan Taipei 10617, Taiwan

²Institute of Physics, Academia Sinica, Nankang Taipei 11529, Taiwan

³Department of Physics, University of Florida, Gainesville, Florida 32611, USA

Recently many nearly degenerate intertwined-ordered states were found in the self-consistent solutions of the renormalized mean-field theory of the lattice t-J model[1] by taking into account the Gutzwiller factor due to Mott physics. Besides the charge density waves (CDW) order, these states also include intertwined orders such as pair density wave (PDW) and/or spin density wave (SDW). The quasiparticle spectra of one of these states, the anti-phase CDW (AP-CDW) state and its superconducting associated state, are calculated to compare with the angle-resolved photoemission spectra (ARPES) of cuprates. These results show many exotic properties of cuprates, such as Fermi arc at normal state, two gaps and particle-hole asymmetry at the antinodal direction at superconducting state[2]. By extending the lattice results to include Wannier functions[3], a continuum local density of states (LDOS) is calculated. The resulting spatial patterns[4] compare very well with the scanning tunneling microscopy (STM) experiments[5]. The symmetry of the intra-unit-cell form factors on the Oxygen sublattice also shows good agreement.

Reference:

[1] Wei-Lin Tu and Ting-Kuo Lee, SciRep 18675(2016).

[2] R. H. He et al., Science 331, 1579 (2011).

[3] A. Kreisel, Peayush Choubey, T. Berlijn, W. Ku, B. M. Andersen, and P. J. Hirschfeld, Phys. Rev. Lett. 114, 217002 (2015).

[4] Peayush Choubey, Wei-Lin Tu, Ting-Kuo Lee⁴, and P. J. Hirschfeld, arxiv:1609.07067.

[5] M. H. Hamidian et al., arXiv1507.07865v1

BIO

T. K. Lee received his B.S. degree from National Taiwan University (Taipei) in 1971, and Ph.D. in Physics from Brown University in 1975. He was a Research Associate in the Department of Physics at City College of City University, New York, 1975 - 1979, and at the Institute for Theoretical Physics at the University of California at Santa Barbara, 1979 - 1981. He was Assistant Professor and Professor of Physics at Virginia Polytechnic Institute and State University, Blacksburg, VA, 1982 - 1997. In 1996, he became a Research Fellow at the Institute of Physics, Academia Sinica in Taipei, and in 1997, also became Head of the Physics Division, National Center for Theoretical Sciences, Hsinchu, Taiwan. From 1997 - 2002, he was Outstanding Scholarship Chair. Dr. Lee's research interests include high temperature superconductivity, nano-materials, X-ray crystallography, protein structure, protein folding, and Quantum Monte Carlo method.

