

T_CSUH Special Seminar

Texas Center for Superconductivity at the University of Houston

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Current Carrying State and Its Implication in a D-Wave Superconductor

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Room 102, University of Houston Science Center
4:00 p.m. – 5:00 p.m.

Abstract

A fundamental property of all known superconductors is the formation of Cooper pairs in the superconducting state. A far-reaching implication of this fact is the quantization of magnetic flux in multiply connected superconducting geometries. In this talk, I will discuss the magnetic flux dependence of order parameter and supercurrent in a hollow d-wave superconducting cylinder. It is shown that the existence of line nodal quasiparticles in a pure $d_x^2-y^2$ pairing state gives rise to an hc/e periodicity in the order parameter and a first-order quantum phase transition for a large system size. We demonstrate that the flux periodicity in the supercurrent is sensitive to the detailed electronic band structure and electron filling factor. In particular, we find that, in cooperation with the increase of the cylinder circumference, the $hc/2e$ periodicity can be restored significantly in the supercurrent by avoiding the particle-hole symmetry point. A similar study of a $d_x^2-y^2+id_{xy}$ pairing state verifies the peculiarity of unconventional superconductors with nodal structure. I will also discuss the possibility of an impurity quantum phase transition as driven by the supercurrent.

Bio

Jian-Xin Zhu is a staff member at the Los Alamos National Laboratory. He received his BS and MS in theoretical physics from Nanjing University (China), and Ph.D. from the University of Hong Kong (China). He did his postdoctoral research at the University of Houston (1997-2001) with Prof. C. S. Ting, and the Los Alamos National Laboratory (2001-2004) as a Director Fellow. His current research interest includes high temperature superconductivity, heavy fermion, and electronic structure calculations of strongly correlated materials. He has published more than 100 papers in peer reviewed journals.

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