



清华大学高等研究院

Institute for Advanced Study, Tsinghua University

物理学术报告 Physics Seminars (biweekly)

Title: Instability of three-band Luttinger liquids: renormalization group analysis and possible application to $K_2Cr_3As_3$

Speaker: Yi Zhou (*Zhejiang University*)

Time: 4:00pm, Wednesday, March 16, 2016
(3:30~4:00pm, Tea, Coffee, and Cookie)

Venue: Conference Hall 322, Science Building, Tsinghua University

Abstract

Motivated by recently discovered quasi-one-dimensional superconductor $K_2Cr_3As_3$ with D_{3h} lattice symmetry, we study one-dimensional three-orbital Hubbard models with generic electron repulsive interaction described by intra-orbital repulsion U , inter-orbital repulsion U' , and Hund's coupling J . As extracted from density functional theory calculation, two of the three atomic orbitals are degenerate and the third one is non-degenerate, and the system is presumed to be at incommensurate filling. With the help of bosonization, we have usual three-band Luttinger liquids in the normal state. Possible charge density wave (CDW), spin density wave (SDW) and superconducting instabilities are analyzed by one-loop renormalization group. The ground state depends on the ratio J/U . For the physical relevant parameter region, $0 < J/U < 1/2$, the ground states are superconducting states. When $0 < J/U < 1/3$, spin singlet superconducting state is favored. While spin triplet superconductor will be favored when $1/3 < J/U < 1/2$. The spin density wave state can be achieved only in the unphysical parameter region $J/U > 1/2$.