北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Electronic Correlations and Multiorbital Effects in Iron-Based Superconductors

Rong Yu

Renmin University of China

Time: 4:00pm, Nov. 26, 2014 (Wednesday)

时间：2014年11月26日 （周三）下午4:00

Venue: Room 607, Conference Room A , Science Building 5

地点：理科五号楼607会议室

Abstract

Identifying the role of electron correlations in iron-based superconductors is crucial in understanding the superconductivity and related normal-state properties in these systems. To this end, we study the metal-to-Mott-insulator transitions in multiorbital Hubbard models for several parent compounds of iron-based superconductors using the slave-spin mean-field method. We show that a crossover from a weakly coupled metal to a strongly coupled metal generally exists in all these models when the Hund's coupling is beyond a threshold. In the strongly coupled metallic phase, the quasiparticle spectral weights are substantially reduced from the non-interacting limit and become strongly orbital dependent. Particularly for alkaline iron selenides, we find a novel orbital-selective Mott phase, in which the Fe 3d xy orbital is Mott localized while the other Fe 3d orbitals remains itinerant. This phase is still stabilized over a range of carrier dopings, and has unique experimental signatures. We further investigate the effects of electron correlations on superconductivity. We have derived the effective exchange coupling between quasi-localized moments in the bad metal regime. This allows us to study the superconducting pairing via an effective multiorbital t-J1-J2 model. We show that the orbital dependent correlation effect results in a rich pairing phase diagram. In a certain parameter regime, it naturally gives rise to orbital selective pairing, which leads to anisotropic superconducting gaps along the electron Fermi pockets and splitting of spin resonance peak in the superconducting state.

About the Speaker

Dr. Rong Yu is an associate professor of physics at Renmin University of China. He received his Ph.D. degree from University of Southern California in 2007. He spent two years at University of Tennessee, Knoxville (2007–2009) and four years at Rice University (2009-2013) as a postdoctoral research associate before he joined the faculty at Renmin University. He has been working on theory of correlated electronic systems. Current research interests include phase transitions in heavy fermion systems, frustration and disorder effects in quantum magnets, superconductivity and correlation effects in iron-based superconductors.