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

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

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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