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Exotic Physics from Doping a Strongly Spin-Orbit Coupled Mott Insulator

YUE CAO, University of Colorado at Boulder

Doping a Mott insulator, as in the case of high T_c cuprates, has given rise to many exotic physics in the doping diagram, such as the pseudogap, Fermi arc and vortex phase. An important topic in these strongly correlated systems is to distinguish the properties that are intrinsic to the Mott physics from those that are materials specific. Recent studies of Sr_2IrO_4, whose Mottness requires strong spin orbit coupling, provide a new venue to look into the topic, where the spin, orbital, charge and lattice degrees of freedom interact. Using ARPES we studied the evolution of the electronic structure of Sr_2IrO_4 with both Rh and La doping. We show that the Rh substitution acts as immobile effective local holes, without a strong renormalization of the overall band structure, while La acts as an electron dopant. Particularly interesting is the lightly hole-doped regime, which showcases some of the same exotic physics as seen in the cuprates, including pseudogaps and Fermi arcs. By observing the scattering rate evolution as a function of energy and temperature, we confirm the non-Fermi liquid nature of the Fermi arc.