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Doping and temperature evolution of the pseudogap state of bulk electron-doped Sr_2IrO_4

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Sr_2IrO_4 is a layered perovskite isostructural to the high Tc cuprate superconductor La_2CuO_4. The strong spin-orbit coupling of the 5d Ir^{4+} ions lifts the degeneracy of the t_{2g} orbitals resulting in a single narrow half-filled band described by pseudospin $J_{eff}=1/2$ degrees of freedom. This promotes a Mott insultating ground state with antiferromagnetic order below 240 K despite the modest Coulomb interaction in the Ir 5d shell. These similarities with cuprates extend to the unusual metallic state of lightly electron doped Sr_2IrO_4 characterized by Fermi arcs and a pseudogap [1]. Based on this analogy, d-wave superconductivity was predicted [2] but to date no superconductivity was observed down to 100 mK.
In this presentation, I will show Angle Resolved Photoemission (ARPES) results on electron doped bulk crystals up to 10% doping, nearly two times higher than previously achieved. Our results show that nodal states become more coherent with increased doping while the antinodal pseudogap persists up to the highest doping. Following the temperature evolution of these features, we show that the pseudogap closes around 200 K for 10% doping. Concomitantly, we find a redistribution of spectral weight along the Fermi surface, reminiscent of the doping induced spectral weight redistribution in cuprates [3].

[1] A. De La Torre et al., Physical Review Letters, 115, 176402 (2015).
[2] F. Wang and T. Senthil, Physical Review Letters, 106, 136402 (2011).
[3] M. Platé et al., Physical Review Letters 95, 077001 (2005).