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Nature of the pseudogap in Rh doped Sr_2IrO_4

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Many correlated systems exhibit an anomalous shape of the metallic band near the Fermi level, called a « pseudogap ». Its origin may differ which leads to different behaviors. The understanding of microscopic mechanisms is a key to move forward towards a better understanding of correlated systems.

The spin-orbit Mott insulator Sr_2IrO_4 is particularly interesting and has been an active field for more than 10 years. It has an electronic structure similar to the cuprates. Some theoretical studies expected it to be superconductor upon doping [1]. The substitution Iridium/Rhodium acts like a hole doping. It presents a transition from Mott insulator to incoherent metal. In the metallic phase, we call it incoherent as it lacks quasiparticle peak and has a pseudogap all along the Fermi surface.

Angle-resolved photoemission (ARPES) is a powerful technique to study low energy physics such as pseudogaps. A recent study combining ARPES and cluster oriented DMFT on $Sr_2Ir_{0.85}Rh_{0.15}O_4$ shows an interesting feature about this pseudogap [2]. As shown in Fig. 1, its depth is highly dependent on experimental condition all along the Fermi surface. Surprisingly, this pseudogap was also found at the X point, far from k_F. At X, the value of the pseudogap is independent of the experimental condition and is about 30 meV.

Theory and experiment have been combined to set a solid basis to discuss the possible meaning of this pseudogap.

[1] H. Watanabe et al., Phys. Rev. Lett. 110, 027002 (2013)
[2] A. Louat et al., Phys. Rev. B 100, 205135 (2019)

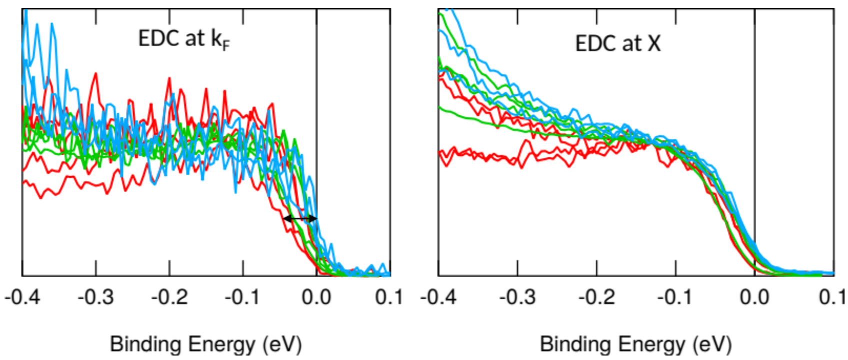

Figure 1 : Energy distribution curves in $Sr_2Ir_{0.85}Rh_{0.15}O_4$ at k_F and at X for different experimental condition. The leading edge (pseudogap) of EDCs at kF shows a large variability while it's similar for all experimental configurations at X.