Superconductivity and PseudoGap in high-Tc cuprates: The Fox and the Hound

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The mechanism of high critical temperature (Tc) superconductivity has remained one of the most fascinating open problems in condensed matter physics. Key questions and theoretical models have been identified since early times, however their resolution has revealed a formidable challenge. In this problem, the strong electronic correlation plays a major role, but it represent a bottleneck as it cannot be treated within standard methods.

In this talk I present recent advances obtained in this field thanks to the development of a theoretical approach that is capable to coupe with the electronic correlation: the cluster dynamical mean field theory. I present results on the two dimensional Hubbard Model, which captures the physics of high-temperature cuprate superconductors. I focus in particular on the relation between the superconducting gap and the so-called “pseudogap” a mysterious spectral-weight depression appearing in the normal phase above Tc. The link between these two phenomena is believed to hold the key to understand the high Tc superconducting mechanism. I show that this relation is a love-hate one, displaying at the same time a competition which produces an unconventional superconducting pairing, but also a mechanism that can boost up Tc.

I show that these theoretical findings leave clear fingerprints in the Raman response, which our experimental collaborators have been able to measure. The good agreement between our theory and experiments strongly support our scenario on the relationship between pseudogap and high Tc superconductivity.

References:

[1] S. Sakai et al. Phys. Rev. Lett. 111, 107001 (2013).
S. Sakai, M. Civelli, and Masatoshi Imada, Phys. Rev. Lett., 116, 057003 (2016).
Helena Braganca, Shiro Sakai, M. C. O. Aguiar, Marcello Civelli
Phys. Rev. Lett. 120, 067002 (2018).

[2] B. Loret et al., Phys. Rev. Lett., 116, 197001 (2016).
B. Loret et al., Phys. Rev. B 96, 094525 (2017).