The Abdus Salam
International Centre
for Theoretical Physics

International Conference on
Multi-Condensate Superconductivity and Superfluidity in Solids and Ultra-Cold Gases
14 - 18 May 2018 (Trieste, Italy)

Orbital Selectivity from High and Low-energy Scales: The Key Feature of Iron-based Superconductors Physics

Laura FANFARILLO
(Condensed Matter Theory SISSA, Trieste)

Unconventional superconductivity is usually found in correlated materials as a low temperature bridge between phases dominated by high- and low-energy scale of electronic interactions (e.g. Mott physics vs Fermi Liquid regime). The understanding of the nature and strength of correlations is key to unveil the nature of the pairing itself as well as its role as competitive/cooperative order with other ordered phases.

The multiorbital character of the electronic band structure close to the Fermi level complicates the analysis of correlation effects in many unconventional superconductors. In particular in Iron-based materials, contrasting experimental evidences of weak and strong regime of electronic correlation polarized theoretical approaches around low-energy effective models [1] or, on the opposite side, strongly correlated approaches [2].

In this talk I will show that complementary and consistent results concerning the physics of iron-based materials follow from both low- and high- energy approaches once the multiorbital character is taken into account [3,4,5]. The orbital selectivity emerges as a main feature at every scale. Our results discloses a new scenario in which the key ingredient of the pairing itself comes from a new and unconventional cooperative interplay between low- and high-energy scale of electronic interactions.

[1] R. Fernandes, A.V. Chubukov, Rep. Prog. Phys. **80**, 014503 (2017)
[2] L. De Medici, Springer Series in Materials Science, Vol. **211**, 409 (2015)
[3] L. Fanfarillo, G. Giovannetti, M. Capone and E. Bascones, Phys. Rev. B **95**, 144511 (2017)
[4] L. Fanfarillo, J. Mansart, P. Toulemonde, H. Cercellier, P. Le Fevre, F. Bertran, B. Valenzuela, L. Benfatto, and V. Brouet, Phys. Rev. B **94**, 155138 (2016)
[5] L. Benfatto, B. Valenzuela, L. Fanfarillo, arXiv: 1804.05800