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Non-Equilibrium Mott-like electronic in high-temperature cuprate superconductors

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Given the complexity of the Fermi surface in complex materials at equilibrium and out of equilibrium [1], momentum-resolved spectroscopy is an important tool for understanding the sperconductivity in copper oxide-based compounds.

However, only recently it became possible to combine the momentum resolution of conventional ARPES with a non-equilibrium ARPES approach, by using ultrafast photon source in the UV and EUV spectral regions [2].

Here I will give the first report about both the nodal and anti-nodal excitations in Bi2212 as detected by time resolved ARPES, along with the dynamics of the low-lying energy states related to the O-2p orbitals.

Although novel and interesting, these results, obtained using a HHG photon source, have a limited momentum-energy resolution. To overtake this problem we have designed and built a novel ultrafast 9.3 eV laser source operating at repetition rates of several hundred of kHz, obtaining tr-ARPES data up to ~ 1Å-1 in the momentum space with an energy resolution of ~ 35 meV [3]. Hence unlocking the gate for a comprehensive understanding of the relaxation dynamics in cuprate and iron-based superconductors over the entire Brillouin Zone [8].

References
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[2] F. Frassetto et al., Opt. Expr. 19, 19169 (2011)
[3] F. Cilento et al., J. Electr. Spectrosc. Relat.Phenom. 207, 7 (2016)