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Resonant Inelastic X-ray Scattering Study of Excitations in Cuprate Superconductors

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The mechanism of high-TC superconductivity in cuprates remains an unsolved question since its discovery in 1986. Answering the question of its microscopic origin turns out to be a great challenge, complexity arises from the coexistence of several phases along with the superconductivity. While it has been argued that spin fluctuations may be crucial for forming superconductivity [1], abundant experimental observations also demonstrate a strong electronic coupling to the lattice [2]. Although electron-phonon coupling may not be the main origin of the Cooper pairing, its role across the phase diagram is still controversial, particularly in the under-doped region [3]. A direct way to probe the electron-phonon coupling has emerged thanks to the recent progress made in high resolution Resonant inelastic X-ray scattering (RIXS), which now allows to resolve phonons [4, 5]. Theoretical studies suggested that the RIXS phonon cross-section directly reflects the momentum-dependent electron-phonon coupling strength [6]. In this talk, we will focus on the dynamical properties of the under-doped cuprate Bi2Sr2CaCu2O8+δ. Low energy excitations were investigated using RIXS at the Cu L3-edge with an energy resolution of 40-45 meV [5]. In the quasi-elastic region, an incommensurate charge density wave (CDW) was observed in this system, confirming its existence in this compound. In addition, this RIXS study resolved the bond-stretching phonon in the energy-momentum space. Importantly, it also revealed that the phonon dispersion changes at the CDW wave-vector indicating that the CDW unambiguously affects the lattice. RIXS measurements on another superconducting cuprate, Ca2-xNaxCuO2Cl2, will be also discussed [7].

[1] D. J. Scalapino, Rev. Mod. Phys. 84, 1383–1417 (2012)
[2] A. Lanzara, et al., Nature 412, 510-514 (2001) ; W. Meevasana, et al., Phys. Rev. Lett. 96, 157003 (2006)
[3] M. K. Crawford, et al., Science 250, 1390 (1990) ; K.-P. Bohnen, et al., Europhys. Lett. 64, 104 (2003) ; F. Giustino, et al., Nature 452, 975 (2008) ; O. Rosch, et al., Phys. Rev. Lett. 92, 146403 (2004) ; M. d'Astuto, et al., Phys. Rev. B 88, 014522 (2013)
[4] Y.Y. Peng, et al., Phys. Rev. B 92, 064517 (2015)
[5] L. Chaix, et al., Nature Physics 13, 952-956 (2017)
[6] L. J. P. Ament, et al., Europhys. Lett. 95, 27008 (2011) ; T. P. Devereaux, et al., Phys. Rev. X 6, 041019 (2016)
[7] L. Chaix, et al., in preparation.

Summary

Topic

1. Excitations of strongly correlated electron systems

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