Electronic and Magnetic Excitations of Cuprates $La_{2-x}Sr_xCuO_4$ Revealed by Soft X-ray RIXS

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Abstract

The study of elementary excitations in cuprates is of great importance to reveal the spin fluctuations and the electron-phonon coupling in high-temperature superconductors. Here we report O K-edge resonant inelastic scattering X-ray scattering (RIXS) measurements to reveal charge-transfer, bi-magnon and phonon excitations in undoped and underdoped $La_{2-x}Sr_xCuO_4$. With an improved energy resolution of 25 meV, we observed charge-transfer excitons of Zhang-Rice spin singlet and bi-magnon excitations, which consist of coherent excitations involving spin flips of two neighboring sites with opposite direction. The energy and dispersion of the observed bi-magnon excitations lend support to the existence of magnon-magnon interaction is the undoped cuprate. Implications of these observed electronic excitations will be discussed in detail.

Keywords – X-ray scattering, RIXS, superconductivity.