

Continued symmetry and momentum-resolved analysis of charge transfer excitation in Mott-insulator La₂CuO₄

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We have performed resonant inelastic x-ray scattering study on charge transfer excitations in parent materials of high-T_c superconductors, La₂CuO₄ and HgBaCuO_{4+d}. Detailed polarization dependence are measured at various momenta and a strong polarization dependence that is characteristic of Raman scattering can be ruled out.

Keywords : Resonant inelastic X-ray scattering, cuprate, Mott

1. Purpose

We proposed to continue an ongoing effort to study the charge-transfer dynamics of strongly correlated electron systems, in particular Mott insulating and high-T_c superconducting cuprates using resonant inelastic X-ray scattering (RIXS) at the Cu K edge.

2. Method

We measured the RIXS spectra of La₂CuO₄ and HgBa₂CuO_{4+d} in a range of scattering geometries near the Cu K edge to look for systematic changes in the RIXS cross section that may provide new information about charge-transfer and related excitations in these cuprate materials.

3. Result

We have studied the RIXS signal on LCO and Hg1201 in a variety of scattering geometries in an attempt to make a connection between the polarization, momentum transfer, incident energy, and energy transfer dependence of RIXS signal. Through a careful analysis which includes very special geometries, we have ruled out a strong polarization dependence that is characteristic of Raman scattering. Instead, it seems that the RIXS signal is controlled mainly by the momentum transfer.

4. Conclusion

Since the momentum transfer variable is related to the real-space extent of the induced excitations, our result provides a possible in-road to studying the real space shape of induced excitations. We are currently exploring this possibility both experimentally and theoretically.

5. Reference

Lu et al, PRL 95, 217003 (2005)
Lu et al, PRB 74, 224509 (2006)