Resonant inelastic x-ray scattering study of electronic excitation in stripe cuprate compound Nd-LSCO

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We report energy resolved resonant inelastic X-ray scattering measurement of charge excitations across the Mott gap in $(La_{1.28}Nd_{0.6}Sr_{0.12})CuO_4$. Momentum dependence of spectral features is studied across the two dimensional Brillouin zone at temperatures above and below the stripe phase transition, and no significant difference is observed.

Keywords : Stripe phase, x-ray scattering, cuprate

1. Purpose

The compound $La_{1.28}Nd_{0.6}Sr_{0.12}CuO_4$ is a model system for study of the stripe phase, and has been shown by ARPES to have unorthodox 1D-like band structure at low temperature [1]. We have successfully used resonant inelastic X-ray scattering (RIXS) at SPring-8 BL11XU to probe the energy resolved charge excitation spectrum across the two dimensional Brillouin zone at temperatures above and below the stripe phase transition.

Polarization was maintained in the a-c plane, and incident energy was tuned to 8.993eV, close to the large 8.991eV c-axis (perp. To Cu-O plaquette) fluorescence peak associated with resonance from c-axis polarization in LCO [2]. Observed dispersion is symmetric in the $(0,\pi)$ and $(\pi,0)$ 2D crystallographic directions, and greatest in the (π,π) direction. Magnitude of the Mott gap and details of peak shape are similar to previous reports for hole doped La-Sr-Cu-O [3].

2. Method

The SPring-8 BL11XU inelastic X-ray spectrometer and was used to identify copper K-edge resonance features and to perform energy resolved x-ray scattering measurements at momentum transfer values across the two dimensional Brillouin zone.

3. Result

Low energy charge mode spectral weight was measured at momenta spanning the two dimensional Brillouin zone, for temperatures above and below the stripe order transition. Observed dispersion is symmetric in the $(0,\pi)$ and $(\pi,0)$ crystallographic directions, and greatest in the (π,π) direction. Magnitude of the Mott gap and details of peak shape are similar to previous reports of hole doped La-Sr-Cu-O [3]. Little change was seen in spectra across the critical temperature for stripe order.

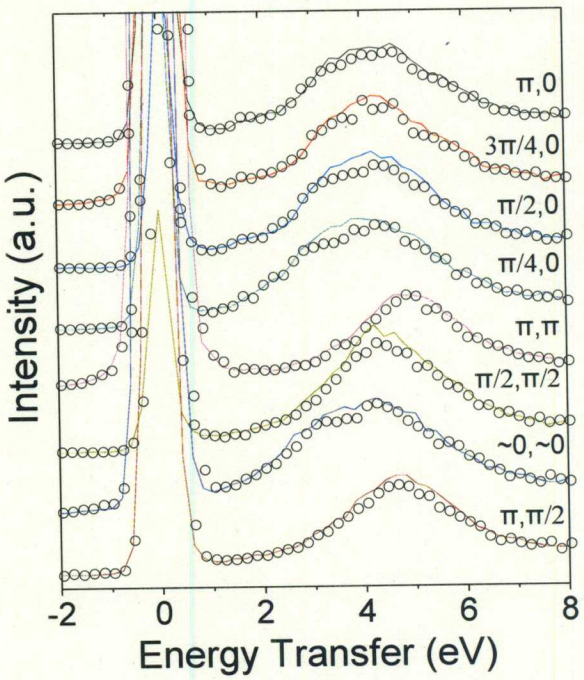

Fig. 1: RIXS intensity at 300K (circles) and 12K (solid lines) is similar for the momenta studied.

4. Conclusion

Charge collective excitations were in $La_{1.28}Nd_{0.6}Sr_{0.12}CuO_4$ were successfully studied by inelastic X-ray scattering at incident energy E=8.993keV, with momentum and temperature resolution across the full Brillouin zone. No significant

difference between high- and low-temperature (stripe phase) spectra is reported.

5. Reference

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