

# Electronic excitations in cuprates and other transition metal compounds studied by $L_3$ edge resonant inelastic x-ray scattering

Giacomo Ghiringhelli

*Coheretia-CNR/INFM and Dipartimento di Fisica, Politecnico di Milano, piazza Leonardo da Vinci 32, 20133 Milano, Italy*

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Resonant inelastic x-ray scattering (RIXS) performed at the  $L_3$  edge of 3d transition metals can be used to study charge neutral excitations in strongly correlated electron systems. In particular the technique can give access to low energy electronic excitations with element specificity and in a transparent way.  $L_3$  edge RIXS, if performed with linearly polarised radiation, can reveal the symmetry of crystal field ( $dd$ ) excitations [1].

The usual limitations are the insufficient energy resolution and signal intensity on the detector, but the recent technical progress in the field of x-ray emission spectroscopy have been opening new exciting possibilities.

We present some examples of RIXS spectra of cuprates [2], manganites, vanadates and other compounds recently measured with energy resolution ranging 300 meV to 600 meV. The presence of crystal field excitations related to local tetragonal distortions in those compounds is discussed. We also show how  $L_3$  edge RIXS is complementary to K and  $M_{2,3}$  edge RIXS.

The promising results obtained with our soft x-ray spectrometer (called AXES) installed at the beam line ID08 of the ESRF have motivated the construction of a new instrument for the Swiss Light Source. It will be capable of working with combined energy resolutions of 40 meV to 100 meV, opening the way to the detection of electronic and magnetic excitations on a new energy scale. SAXES (this is the name of the new spectrometer) will be accessible to users at the ADDRESS beam line of the SLS from the first months of 2007 [3].

## References

[1] G. Ghiringhelli *et al* J. Phys. Cond. Matt. **17**, 5397 (2005)

[2] G. Ghiringhelli *et al* Phys. Rev. Lett. **92**, 117406 (2004)

[3] G. Ghiringhelli, A. Piazzalunga, C. Dallera, G. Trezzi, L. Braicovich, T. Schmitt, V. N. Strocov, R. Betemps, L. Patthey, X. Wang and M. Grioni, submitted to Rev. Sci. Instrum.