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Low-Energy Electronic Excitations in the Layered Cuprates Studied by Copper L₃ Resonant Inelastic X-Ray Scattering¹

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Resonant inelastic x-ray scattering (RIXS) can be effectively used to measure the energy and symmetry of neutral electronic excitations in solids. In the soft x-ray range it is particularly powerful for strongly correlated electron systems based on 3d transition metals, because at the L_{2,3} edges it involves directly the 3d states. In those systems it can be considered as a chemically selective, bulk sensitive alternative to optical absorption and electron energy loss spectroscopy in the study of low energy electronic excitations. The reduced intensity and the instrumental energy resolution usually hinder the detection of very detailed spectral features, but the recent progress in the energy resolving power of our RIXS apparatus has opened new exciting possibilities in the 400-1000 eV range. We present spectra measured using the AXES spectrometer, installed at the beam line ID08 of the ESRF, France. The combined resolution ranges from 240 meV to 650 meV going from the Ti to the Cu L₃ edges. We have measured the *dd* excitations in cuprates [1,2,3,4] and other interesting systems where electronic correlation plays a central role [5]. In the specific case of cuprate superconductors, L₃ RIXS can be used to estimate the energy of the *xy*, *yz*, *zx* and *z*² excited states. We report the examples of La₂CuO₄, CaCuO₂, Tl2212 and Nd_{1.2}Ba_{1.8}Cu₃O₇, where the different coordination and Cu-O distances result in a variety of *dd* excitation spectra.

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