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Spin Dynamics and Electron-Phonon Coupling in Cuprates Measured by Resonant Inelastic X-Ray Scattering JEROEN VAN DEN BRINK, Leibniz Institute IFW Dresden, Germany, LUUK AMENT, Leiden University, The Netherlands, LUCIO BRAICOVICH, GIACOMO GHIRINGHELLI, Politecnico di Milano, Italy — We show how Resonant Inelastic X-ray Scattering (RIXS) is able to measure not only the dispersion of collective electronic and magnetic excitations in High Tc cuprates [1], but also their coupling to the lattice. At the Cu L_3 edge we observe the collective magnetic modes of La_2CuO_4 (LCO) and underdoped $La_{2-x}Sr_xCuO_4$ (LSCO) [2,3]. In LCO the single magnon dispersion measured by RIXS coincides with the one determined by inelastic neutron scattering. For LSCO the spin dynamics shows a branch dispersing up to $\sim$400 meV coexisting with a branch at lower energy [3]. Only the latter has been observed with neutrons so far and is considered a key signature of doped cuprates. The presence of the high-energy branch indicates that LSCO is in a dynamic inhomogeneous spin state. RIXS also provides direct, momentum-resolved information on the coupling between electrons and phonons. With it, we determine the e-p coupling strength of the Cu-O breathing mode in La_2CuO_4 and show that this coupling is strong enough to bring the material close to the polaron self-trapping regime when it is lightly doped with holes. [1] L. Ament *et. al.*, PRL 103, 117003 (2009). [2] L. Braicovich *et. al.*, PRL 102, 167401 (2009) [3] L. Braicovich *et. al.*, ArXiv:0911.0621 (2009).

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