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Influence of apical oxygen on the extent of in-plane exchange interaction in cuprate superconductors YINGYING PENG, GIACOMO GHIRINGHELLI, Politecnico di Milano, Italy — In high T_c superconductors the magnetic and electronic properties are determined by the probability that valence electrons virtually jump from site to site in the CuO_2 planes, a mechanism opposed by on-site Coulomb repulsion and favored by hopping integrals. The spatial extent of the latter is related to transport properties, including superconductivity, and to the dispersion relation of spin excitations (magnons). Here, measuring by resonant inelastic x-ray scattering over a significant portion of the reciprocal space and with unprecedented accuracy, we compare the magnetic spectra for three antiferromagnetic parent compounds (single-layer $Bi_2Sr_{0.99}La_{1.1}CuO_{6+\delta}$, double-layer $Nd_{1.2}Ba_{1.8}Cu_3O_6$ and infinite-layer $CaCuO_2$) differing by the number of apical atoms. We observe that the absence of apical oxygens increases the in-plane hopping range and, in $CaCuO_2$, it leads to a genuine 3D exchange-bond network. These results establish a corresponding relation between the exchange interactions and the crystal structure, and provide fresh insight into the materials dependence of the superconducting transition temperature.

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