

Persistent high-energy spin excitations in RIXS spectra of optimally doped Bi-2212

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We have exploited high-resolution resonant inelastic x-ray scattering (RIXS) at the Cu L3 edge to measure the full spectrum of spin excitations in Bi-2212. We find that the magnon dispersion and spectral line shape of the insulating Y-substituted parent compound are very similar to those of the AFM insulator Sr₂CuO₂Cl₂ [1]. Namely, we observe a dispersion along the magnetic zone boundary, indicative of interactions beyond nearest-neighbors. We also find that clear signatures of spin waves persist in superconducting underdoped and even optimally doped Bi-2212 samples, but develop a remarkable anisotropy. Along the nodal direction the magnon peaks are well-defined and follow the dispersion of the parent insulator. By contrast, only a broad quasielastic tail is seen in the anti-nodal direction. These results suggest a similar anisotropy of the coherence length of the paramagnons.

[1] M. Guarise et al., Phys. Rev. Lett. 105, 157006 (2010)

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