Exploring the physics of quantum matter with high resolution RIXS

Giacomo Ghiringhelli

Politecnico di Milano, Dipartimento di Fisica CNR-SPIN

Accademia Nazionale dei Lincei

In some materials or artificial systems, inherently quantum properties may emerge at macroscopic scale and give rise to powerful phenomena such as superconductivity or ferro-like orders. Those effects are often issued by strong electronic correlation or by reduced dimensionality. In transition metal oxides correlation often leads to a complex landscape of intermixed degrees of freedom, whose richness defies the understanding based on traditional scenarios valid for "normal" materials. The best know example is that of cuprate high Tc superconductors.

In 3*d* transition metal systems, resonant inelastic x-ray scattering (RIXS) can be used very effectively to measure the spectrum of several low- and intermediate-energy excitations and their entwining, such as orbital (crystal field), spin, charge and vibrational excitations. Keys for success of RIXS are high energy resolution, good control of the sample position and orientation, good knowledge of cross sections.

I will provide a survey of our recent work on cuprate parent compounds and superconductors and on infinite layer nickelates, which share several properties with high Tc superconductors. I will present mostly unpublished results on fractionalized spin excitations [1], dispersing orbital excitations, charge order [2] and charge density fluctuations, doping dependent electron phonon coupling [3] and *T*- dependent low energy charge excitations, in various compounds including YBCO, $CaCuO_2$ and $Nd_{1-x}Sr_xNiO_2$. I will also mention the unusual case of AgF_2, where pioneering RIXS data at fluorine K edge provide insight on the electronic structure [4].

References

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