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Momentum Resolved Resonant Inelastic X-Ray Scattering on Correlated Electron Materials

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Abstract content

Resonant Inelastic X-ray Scattering (RIXS) is a powerful probe of excitations from the electronic ground state of correlated materials involving lattice, charge, orbital and spin degrees of freedom. The experimental development of the RIXS technique in the soft X-ray energy range has been tremendous during the last years. Several instruments at synchrotron radiation sources world-wide have recently boosted the scientific capabilities with soft X-ray RIXS. The ADRESS beamline of the Swiss Light Source at the Paul Scherrer Institut and its RIXS spectrometer SAXES have increased the resolving power for the incident and the outgoing X-ray beam to above 10'000. Such an extremely high spectral resolution and the possibility to rotate the spectrometer to different scattering geometries allows for analysing the collective behavior of charge, orbital and spin excitations by assessing their momentum dependence.

In this talk we illustrate the scientific capabilities of momentum resolved soft X-ray RIXS on correlated electron materials in investigations on quasi-one dimensional cuprates, cuprate- and iron pnictide superconductors as well as oxide heterostructures. We observed dispersive orbital excitations, „orbitons", in the spin chain compound Sr2CuO3, which are related to the separation of the spin and orbital degree of freedom [1]. In hole and electron doped cuprate superconductors (para)-magnon excitations persist across the whole phase diagram. Novel collective modes in Nd2-xCexCuO4 are indicative for the presence of a symmetry–broken state and the occurrence of a quantum critical point in the superconducting dome of this cuprate [2]. Persistence of dispersing high-energy spin excitations throughout the whole phase diagram in hole- and electron doped BaFe2As2 reveals the presence of doping-independent fluctuating magnetic moments in iron pnictides [3]. RIXS on LaAlO3 / SrTiO3 superlattices is probing the localized and delocalized Ti 3d electrons as well as the orbital reconstruction at the interface of these oxide heterostructures. [4]

References:

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Summary

Primary author(s) : Dr. SCHMITT, Thorsten (Paul Scherrer Institute)

Presenter(s) : Dr. SCHMITT, Thorsten (Paul Scherrer Institute)

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