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Observation of Spin-Orbital Separation in the spin chain Sr2CuO3 with Resonant Inelastic X-ray Scattering

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Resonant Inelastic X-ray Scattering (RIXS) is a powerful probe of excitations from the electronic ground state in transition-metal oxides. In this talk we present high-resolution RIXS studies of magnetic and electronic excitations in the low dimensional spin chain system Sr2CuO3 performed at the ADvanced RESonant Spectroscopies (ADRESS) beamline of the Swiss Light Source with the SAXES spectrometer [1].

In general, quantum effects become important when the space symmetry is lowered. In the extreme case of one-dimensional-materials the electron can break up into separate quasi-particles, i.e., spinons, holons and orbitons that carry their respective spin, charge and orbital degrees of freedom [2]. Sr2CuO3 is an ideal realization of the one-dimensional Heisenberg spin-1/2 chain. When an electron is removed from this spin-chain one can for instance observe how spin and charge degrees of freedom are splitting in the so called spin-charge separation mechanism [3].

Our Cu L3-RIXS measurements on Sr2CuO3 reveal the fractionalization of magnons into two-spinons and higher order excitations as previously reported from neutron scattering [4]. Furthermore, we observe the splitting of an orbital excitation into the independently propagating spinon and orbiton quasi-particles [5]. This newly observed spin-orbital separation phenomenon gives thereby rise to strongly dispersive orbital excitations (orbitons) [6].

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