

# Observation of Spin-Orbital Separation in the spin chain Sr<sub>2</sub>CuO<sub>3</sub> 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 Sr<sub>2</sub>CuO<sub>3</sub> performed at the ADvanced RESonant Spectroscopies (ADDRESS) 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]. Sr<sub>2</sub>CuO<sub>3</sub> 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 L<sub>3</sub>-RIXS measurements on Sr<sub>2</sub>CuO<sub>3</sub> 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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[6] K. Wohlfeld, M. Daghofer, S. Nishimoto, G. Khaliullin and J. van den Brink, *Phys. Rev. Lett.* 107, 147201 (2011).

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