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Elementary spin and orbital excitations in low-dimensional Cuprates

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Quantum effects become important, when the space symmetry is lowered. In the extreme case of one dimension the fundamental degrees of freedom of the electron can break up into separate quasi-particles carrying the spin, charge or orbital degrees of freedom. Here we report on studies of elementary excitations in quasi 1D cuprates, the spin-ladder/spin-chain compound Sr14Cu24O41 and the spin-chain Sr2CuO3, using Resonant Inelastic X-ray Scattering at the SAXES spectrometer at the ADRESS BL of the SLS at PSI, Switzerland. When the incident photon energy is tuned to the Cu 2p-3d resonance, elementary spin and orbital excitations can be observed in the low-energy and medium-energy range of 0-800 meV and 1.5-2.5 eV, respectively. Improvement of theoretical understanding of the X-ray scattering process allows for a quantitative analysis of the data. In the medium-energy range we observe for the first time the deconfinement of spinons and orbitons.

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