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Inelastic X-ray Scattering Studies of Cuprate Spin Dynamics: The case of a single La₂CuO₄ layer

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The dynamics of $S = \frac{1}{2}$ quantum spins on a 2D square lattice lie at the heart of the mystery of the cuprates. In bulk cuprates such as La₂CuO₄, the presence of a weak inter-layer coupling (and other interactions) stabilizes 3D Neel order up to high temperatures. In a truly 2D system however, thermal fluctuations melt long range order at any finite temperature. Here, we utilize Cu L-edge RIXS to measure the spin response of isolated one-unit-cell thick layers of La₂CuO₄. We show that coherent magnons persist even in a single layer of La₂CuO₄ despite the loss of magnetic order, with no evidence for resonating valence bond (RVB)-like spin correlations. We also observe a high-energy magnetic continuum in the transverse and longitudinal magnetic response. This high-energy continuum is not well described any existing theories. In contrast, K-edge RIXS is sensitive to two spin-flip processes and we utilize this to measure the two-magnon response, providing further constraints on the spin Hamiltonian.

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Talk

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