Across the Mott Gap: Electronic Excitations in Transition Metal Oxides

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Studies of the electronic excitations in strongly correlated systems are important because these excitations may play a key role in the materials' behavior and because such measurements provide stringent tests of the various theoretical approaches to the strongly correlated problem. Here, we report inelastic x-ray scattering studies of momentum-resolved excitations in cuprates and manganites.

In the 1D cuprate, $SrCuO_2$ results suggest that the excitation spectrum consists of a holon-anti-holon continuum together with a broad resonance, consistent with a parameter-free calculation of the dynamical response function [1]. In contrast, in the 2D cuprate system, $La_{2-x}Sr_xCuO_4$ [2] better-defined excitations were observed. At x=0, two broad peaks are found that are strongly momentum dependent. Higher-resolution measurements suggest that these are in fact comprised of a number of long-lived excitations. As carriers are doped into the system, excitations below 3eV are replaced by a momentum dependent continuum. Finally, the dependence of the excitations on the electronic ground state is revealed in 3D manganites in which the observed temperature dependence is correlated with changes in the magnetism and associated with intersite *d-d* excitations.

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