Electronic excitations and momentum densities in oxides studied by inelastic X-ray scattering

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The background signals of X-ray Raman scattering experiments, i.e. valence electron excitations and the Compton peak, are wealthy sources of information on the electronic structure and dynamics in condensed matter systems. A very particular strength of non-resonant inelastic X-ray scattering (IXS) is that the scattering cross section can be accurately calculated from state-of-the-art first principles theory, and the probed response function is in fact a fundamental quantity in modern theories of electronic structure of condensed matter. [1,2] This combined with the low interaction cross section, that guarantees bulk sensitivity and minor multiple scattering effects, makes IXS an uniquely clean experiment. Furthermore, IXS experiments can also give insight into complementary methods such as photoemission spectroscopy and resonant inelastic X-ray scattering.

Transition metal oxide compounds are widely studied compounds, in which interesting physical properties arise from electron correlation effects, electron-phonon coupling, magnetic interactions, and combinations thereof. This talk will focus on applications of IXS to two canonical materials: $SrVO_3$ and VO_2. The former is considered a prototypical correlated metal, and is often used as a test case for theoretical development. Recent experimental and theoretical studies have raised an interest in the role of collective electronic excitations in $SrVO_3$, and some first steps in their characterization will be discussed. [2,3,4] The latter compound VO_2 exhibits a metal-insulator transition that is accompanied by a structural phase transition. The Compton profile difference between the metallic and insulating phases will be discussed alongside comparisons to theoretical calculations. [5,6]

References

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