Electronic Excitations: What Inelastic X-ray Scattering can Reveal

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A review of inelastic x-ray scattering (IXS) as a method to investigate electronic excitations in solids is presented, where also some aspects of synchrotron radiation based instrumentation are touched. The direct access to the polarizability of electrons in solids by measuring the dynamic structure factor using non-resonant inelastic scattering is stressed. The weight of different terms in the diagrammatic expansion of the proper polarizability can be tested. Special lattice effects on electron correlation as zone boundary collective states, plasmon Fano resonances and the plasmon band structure will be represented, where the role of coherent inelastic x-ray scattering is stressed. The increasing importance of resonant inelastic x-ray scattering (RIXS) is emphasized. It is the sensitivity of this spectroscopy with respect to the site of excitation, to the spin of the intermediate state and its Bloch-k- and symmetry-selectivity, which opens RIXS a broad field of applications for studies of electronic excitations. Especially shake-up processes in the intermediate state connected with excitations across the Hubbard gap of highly correlated systems have attracted much attention.

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