

Some new ideas on Resonant Inelastic X-ray Spectroscopy

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The talk discusses some new ideas regarding Resonant Inelastic X-ray Spectroscopy (RIXS) [3]. (I will not go into q-dependence effects hence the name 'spectroscopy' instead of 'scattering'). RIXS is a combination of x-ray absorption and x-ray emission. In case of 3d metals popular hard x-ray RIXS channels are the 1s2p, 1s3p and 1sV experiments, where V stands for a valence electron, including the cross-over channel. In the soft x-ray regime, the 2p3d, 3p3d and 2p3s channels are often studied. Many details regarding the physics of the RIXS experiments are still unknown. Future experiments will have to reveal the details of interference effects, resonant versus 'non-resonant' channels, angular dependence, q-dependence, etc.

I will present a simple interpretation of RIXS using charge transfer multiplet theory in combination with the Kramers-Heisenberg description (i.e. only the resonant channel with full interference) [1,2]. This model explains the main features of the observed spectra. Using this model, some new possibilities for experiments will be discussed. In the hard x-ray range, this includes the measurement of soft x-ray spectra with hard x-rays [3], valence selective x-ray absorption [4], spectral sharpening effects [5], measuring through another absorption edge without 'seeing it' [6] and the use of the cross-over peak to study covalence [7]. In the soft x-ray range possible applications include the study of super-exchange interactions [8], the use of the 2p3s channel to determine the 3s exchange interaction [9] and the determination of crystal field effects on 4f states [10].

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