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Many body phenomenon within multiple scattering approach in PEELS

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Synopsis Plasmon excitation within multiple scattering approach is being explored. The plasmon loss is described within the so-called quasi-boson approximation, originally proposed by Hedin and further extended by Fujikawa. We compare the different fluctuation potentials i.e. Plasmon-pole model, Bechstedt model and other available potentials based on beyond-RPA dielectric functions and use either the exact core state wave function or more accurate model than a simple delta function used previously for total energy loss in Aluminium targets.

We consider only plasmon excitation which are excited by electrons. Although all the intrinsic properties of the plasmons remain valid in this case as we study them in PEELS. Photo emission energy loss spectroscopy (PEELS) aims at providing information on the dielectric function near the surface. It consists the monitoring of a plasmon satellite in a photoemission spectrum as a function of the direction of the outgoing electron that has suffered a plasmon loss. In order to be able to derive quantitative information on the (surface) dielectric constant, a suitable theoretical model is necessary upon which we are working presently. We intend to incorporate the present model into the MsSpec computer code MsSpec [1]. We use electron-boson Hamiltonian where plasmon loss is described within the quasi-boson approximation, originally proposed by Hedin [2] and further extended by Fujikawa and co-workers [3]. We have calculated the cross-section for the one-plasmon loss and compared it using various fluctuation potentials and calculated total energy loss for different core wavefunction for Aluminium 2p (Fig.1). The computed cross-section of plasmon peak in terms of core peak (extracted from MsSpec) for one plasmon loss is

$$I^1(\vec{k}, \hbar\omega_{\mathbf{q}}, \hbar\omega_i) = I^0(\vec{k}, \hbar\omega_{\mathbf{q}}) \frac{\alpha(\hbar\omega_i)}{\hbar\omega_i} \quad (1)$$

We are computing the loss function using dielectric function. Overall we explore the im-

portance of taking into account multiple scattering (MS) when the outgoing electron has lost energy through the excitation of a plasmon [4]. Presently the model is for one plasmon and we plan to extend it to two,three plasmons. We also discuss our future plans to extend PEELS study to (e,2e) field on solid targets.

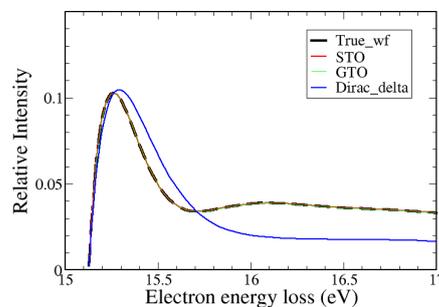


Figure 1. Total energy loss for Aluminium using various core-state wavefunction

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