# Signals of Ionization Potential Depression in X-Ray Thomson Scattering Spectra

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X-Ray Thomson Scattering has evolved into an important diagnostic method for dense matter revealing a number of important properties from the atomic scale structure of strongly interacting ions to modified plasmon shifts in electron-ion systems [1]. It is well known that the scattering signals also highlights changes in the ionization energies. The most basic effect is the changing ionization degree that is reflected in the changing ratio of the elastic to inelastic scattering feature as these parts of the spectrum are roughly proportional to the number of bound and free electrons, respectively. Moreover, the contribution from bound-free scattering shows a cut-off at the effective ionization energy and its shape is thus directly related to the IPD. Both effects have been already exploited in the analysis of experiments [2,3].

There are however also changes to the elastic scattering feature due to IPD that will become increasingly prominent as more extreme conditions are probed, e.g., at the OMEGA or NIF facilities. First we demonstrate that the screening cloud describing the free-electron contribution to the elastic scattering can be directly related to the electronic contribution of the IPD. The ionic part to the IPD is also included as it can be expressed by the ion-ion structure factor. Thus, a complete measure of the elastic Rayleigh weight for all wavenumbers gives a direct measure of the IPD. We demonstrate this effect with different models for the screening cloud [4]. Secondly, the bound states are also modified by the interactions with the environment. The changing binding energies are the IPD while the changes in the wave functions modify the elastic scattering in XRTS. Thus, we have found another direct link between the IPD an ion experiences and its scattering strength that can be measured by XRTS. Of course, the latter effect is small for most conditions investigated so far. However, we demonstrate with a simple hydrogen-like model that it becomes significant for the extreme conditions that can be created and probed by NIF.

## REFERENCES

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