ESRF	**Experiment title:** Compton Scattering Study of Na	**Experiment number**: HE-386
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Report:

We have measured Compton scattering from polycrystalline sodium sample using two different incident energies of 29 and 56 keV. The measured Compton profiles give information on the initial state momentum density. In this specific case our interest was to study the free electron gas momentum density and the so-called quasiparticle renormalization parameter Z_F which is given by the jump at the discontinuity at the Fermi momentum. The previous experiments at lower energies with high momentum resolution have shown that the Fermi break is smeared and the jump reduced. By using two different energies we have systematically tried to investigate the various reasons for this effect and whether it changes as a function of incident energy. These include the energy dependence of the cross section, multiple scattering, energy dependent spectrometer efficiency corrections and breakdown of impulse approximation.

Sodium was selected as target material because the 3s electrons form within a very good approximation a free electron gas and its Fermi surface is known to be very isotropopic. However, being a alkali metal it is very reactive and great concern should be taken to prepare and handle the sample properly. The commercially available pure polycrystalline sodium sample was sealed in a pre-scored ampoule. The 0.74 mm thick disk was cut inside a glove box with safe gas environment, transferred to the beamline under safe gas and measured under vacuum. After the experiment the sample show no visible surface contamination.

At 56 keV incident energy using Si(311) analyzer crystal the momentum resolution was 0.19 a.u. and the average count rate 1150 cps at the Compton peak. For 29 keV incident energy with Si(111) analyzer the corresponding numbers were 0.1 a.u. and 890 cps. The beam size at the sample was 0.2 mm(H) x 5 mm(V). Figure 1 show the experimental Compton profiles converted to momentum scale for both the 29 and 56 keV incident energies after all the experimental corrections. The profiles are identical and only differences due to the better resolution at 29 keV are visible. This suggests that the breakdown of impulse approximation or differences in the multiple scattering are not significantly different for these energies. Moreover, all the energy dependent experimental correction factors seem to work excellently.

More detailed data analysis trying to extract the momentum density n(p) and renormalization parameter Z_F is in progress. The preliminary data analysis suggests that there is a clearly visible higher momentum tail extending above the Fermi break which is not reproduced by the present theories. Theoretical work to improve the model for the electron-electron correlation is in progress.

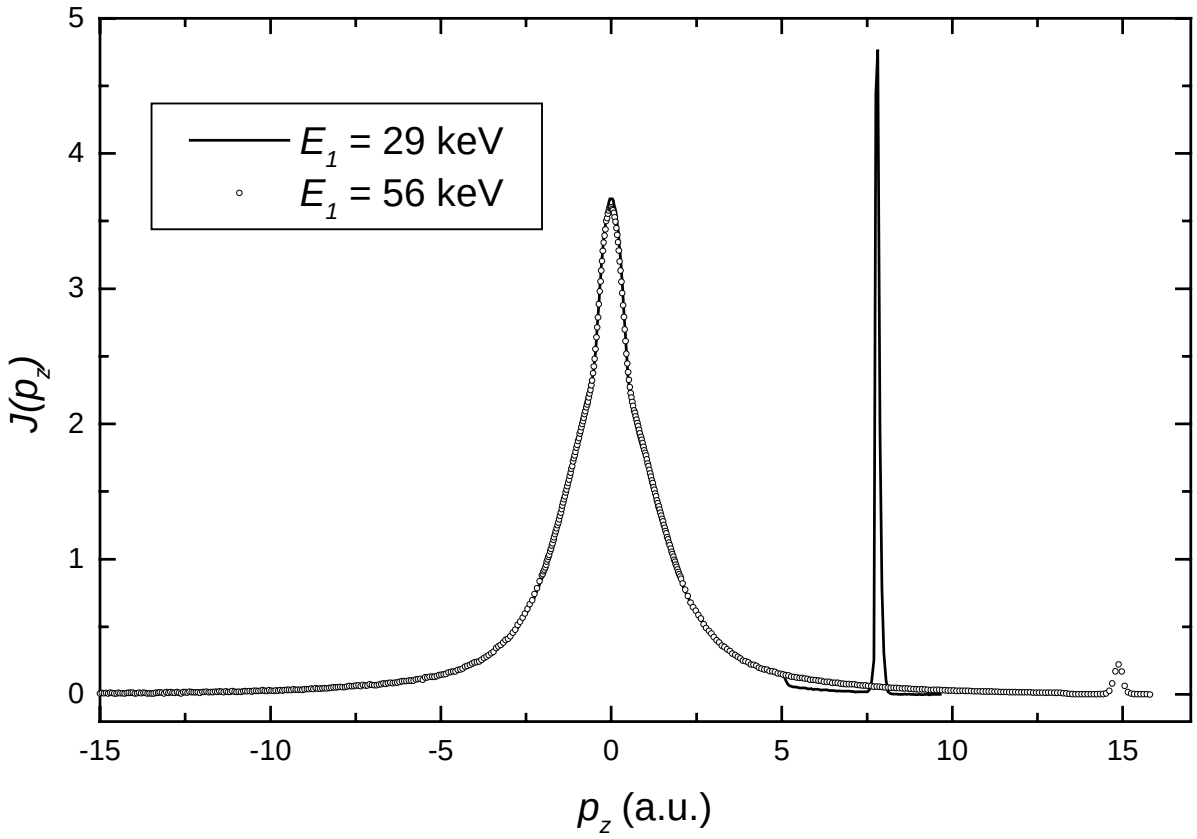

Figure 1. Experimental Compton profiles measured at 29 and 56 keV incident energies.