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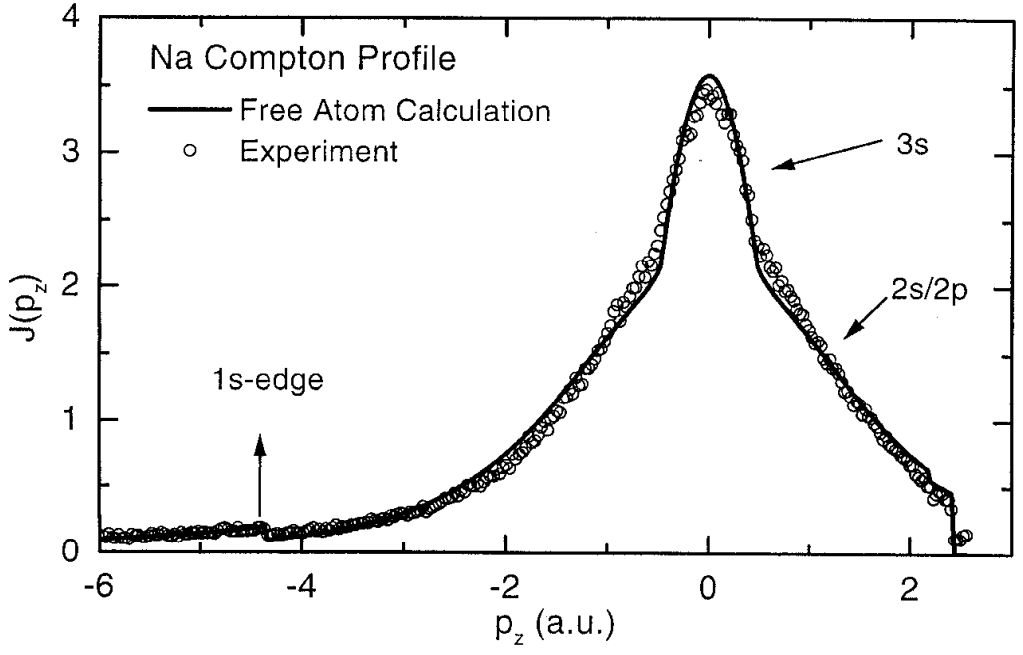
Report:

We have measured high resolution Compton scattering spectra from a polycrystalline sodium sample using backscattering spectrometer at *Inelastic Scattering Beamline* ID16 at ESRF. The scattered photons were analyzed using a spherically bent Si 555 single crystal utilizing Rowland circle geometry with 1 m radius. The energy dependence of the scattering cross section were recorded by scanning the incident photon energy while keeping the scattered photon energy fixed. The Bragg angle for the analyzer was set close to backscattering geometry and was about 88 degrees in order to reach good energy resolution. The measured total energy resolution (incident + scattered) at 9.9 keV was about 1.7 eV. The unfocussed undulator radiation was monochromatized using channel-cut Si 111 crystal and the spot size at the sample was about 1.5 mm x 1.5 mm. The analyzer crystal (usable diameter about 60 mm) was limited horizontally to 30 mm to improve the momentum resolution which turned out to be better than 0.02 a.u. at the Compton peak. During the scans the undulator gap had to be adjusted to reach long enough scanning range.

It is theoretically predicted that with good enough momentum resolution one should see the fine structure in the Compton profile which is related to the Fermi topology of the sample material [l]. However, such fine structures were significantly smeared in the recent high resolution experiment at NSLS [2]. The purpose of this experiment was to study the fine structure of the Fermi break in a simple free-electron-like system in order to understand if this smearing is due to the electron-electron correlation effects or if the smearing is related to the simplifications used in the theoretical model.

During the experiment we measured the full Compton profile of Na (shown in the figure below) and then concentrated in the Fermi surface region. Due to the long scanning range the undulator gap had to be changed several times during the measurement. The purpose of this long scan was merely to see the overall agreement of the Compton profile and to see how well the core electrons follow the impulse approximation. When compared with the free electron/atom theory there seems to be significant extra contribution close to the Fermi break. However, if the core electron contribution is broadened from the free atom calculation the Fermi break sharpens up. The careful analysis of statistically better data in the vicinity of the Fermi break is in process. This analysis is complicated due to the normalization problems when the undulator gap is changed and the spatial shape of the beam spot at the sample is changed.



[l] Y. Sakurai et al., Phys. Rev. Lett. 74, 2251 (1995).
[2] K. Hämäläinen, S. Manninen, C.-C. Kao, W. Caliebe, J. B. Hastings, A. Bansil, S. Kaprzyk and P. M. Platzman, Phys. Rev. B 54,5453 (1996).