

**Experiment title:** Measurement of momentum space densities of  $\text{Cu}_{1-x}\text{Al}_x$  by means of high resolution Compton scattering

**Experiment number:**  
HE 65

**Beamline:**  
ID 15B

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**Report:**

Measurements of directional Compton profiles  $J(p_z)$ , which are the one-dimensional projection of the electron momentum density on the scattering direction, give access to the full 3-dimensional momentum density, the occupation number and the Fermi-surface. The reconstruction can be achieved for example by means of the Fourier-Bessel-method. We have performed measurements of directional Compton profiles for 10 different directions of the momentum transfer  $\vec{q}$  on single crystal Cu. Each spectrum contains of 550 points in an energy range of 40.3-58.3 keV with an incident energy of 57.68 keV. The integral number of counts was  $2.8 \times 10^7$  and the resolution approximately 0.2 a.u. Thus, the new setup of the monochromator crystal increased the intensity by a factor of about 2 compared to previous measurements at the same beamline. Unfortunately we had still problems with an unwanted (551) reflection of the analysing crystal, which spoils the profile for  $-3.0 \text{ a.u.} \leq p_z \leq -1.0 \text{ a.u.}$

An energy dependent correction of the obtained data and a correction for multiple scattering by a Monte Carlo simulation program of J. Felsteiner has been finished yet.

The full 3-dimensional reconstruction of the momentum density and the occupation number is still in progress. The data will supply previous measurements on  $\text{Cu}_{0.953}\text{Al}_{0.047}$  alloys and will be completed by measurements on  $\text{Cu}_{0.9}\text{Al}_{0.1}$  this year.

Fig. 1 presents the anisotropy of the directional Compton profiles compared with calculations by S. Kaprzyk. While the theoretical anisotropy overestimates the experimental anisotropy, the agreement of the zero crossings of  $\Delta J(p_z)$  is very good.

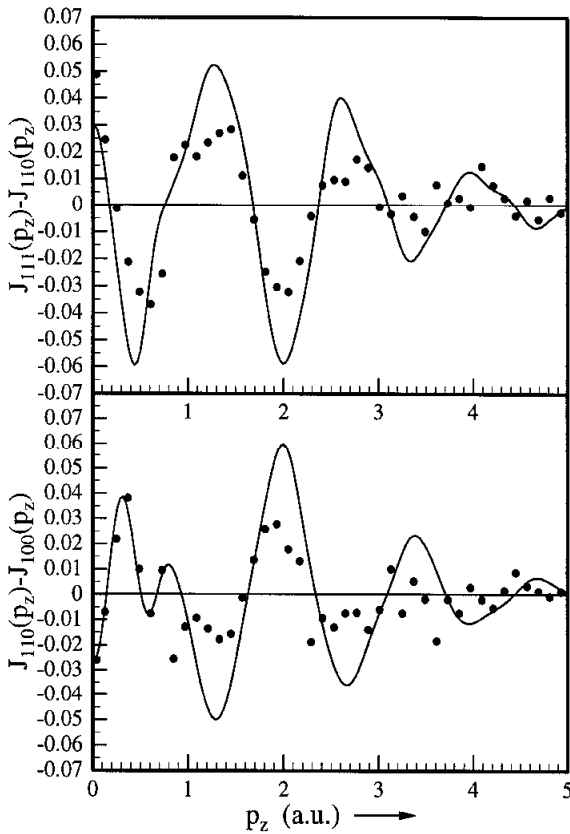


Fig. 1:

Experimental directional Compton profile differences for  $\text{Cu}_{0.953}\text{Al}_{0.047}$  (data points) compared with calculations by S. Kaprzyk (solid line)

top:  $J_{111}(p_z) - J_{110}(p_z)$

bottom:  $J_{110}(p_z) - J_{100}(p_z)$