ESRF	**Experiment title:** High resolution Compton scattering study of Al-Li alloy	**Experiment number:** HE-067
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Report:

The objective of the experiment was to study the fine details of the Fermi surface of Al and AlLi(3.0%) by measuring directional Compton profiles from single crystals. The earlier Compton profile studies have failed to show any differences between profiles corresponding to different crystallographic directions, while electron momentum distributions determined by positron annihilation indicate clear anisotropy [1].

The measurement were carried out using the scanning-type Compton spectrometer at ID15B. The sample crystals were 0.23 mm thick discs cut so tha the principal crystallographic directions made approximately an angle of 10° with the surface. These were aligned along the scattering vector by rotating the sample about the surface normal. The scattering angle was 160° with 60 keV incident radiation and 170° with 50 keV, so that the sample was viewed in a small angle by the analyzer crystal. This geometry combined a large scattering volume with good momentum resolution (0.13 a.u. for 60 keV, and 0.10 a.u. for 50 keV). Typical count-rate at the peak of the Compton profile was 3000 cps.

Small but clear differences between the directional Compton profiles were observed; see Fig. 1. These support the theoretical results, although the differences are smaller than predicted [2]. Theory suggests the most pronounced differences close to the Fermi momentum, and these are seen in the studies by positron annihilation, but not in the Compton profiles.

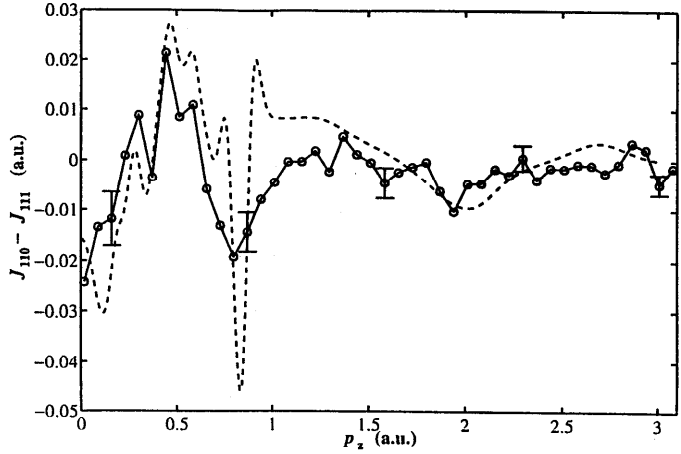

Fig. 1. Difference between normalized Compton profiles for Al in [110] and [111] directions: experiment (points and solid line) and theory (broken line)

There is a very clear over-all difference between the experimental and theoretical Compton profiles, which does not depend on the crystallographic direction. The experimental values are smaller than the theoretical ones below the Fermi momentum and larger above it; see Fig. 2. This increased occupation of the higher momentum orbitals is attributed to electron-electron correlations, which also explain the difference to the positron annihilation studies.

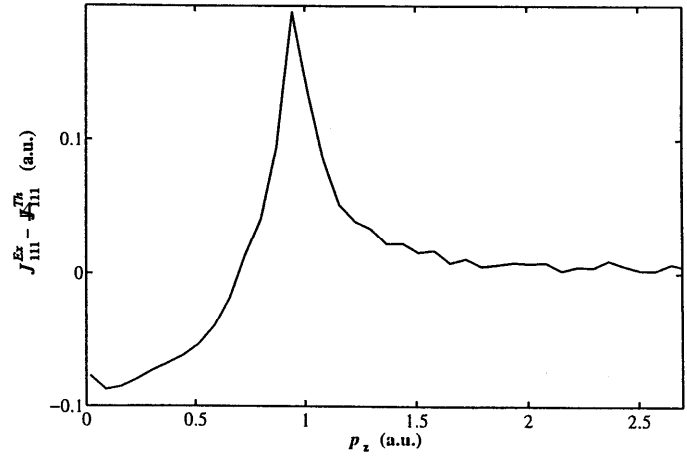

Fig. 2. Difference between norrnalized experimental and theoretical Compton profiles for Al in the [111] direction.

The difference between the Compton profile for Al and AlLi(3.0%) has rather little structure. This indicates that the shape of the Fermi surface does not change essentially with the decreasing electron density of AlLi.

More detailed analysis of the experimental results and comparison with theory in terms of profile derivatives is in progress.

[l] T. Okada, H. Sekizawa and N. Shiotani, J. Phys. Soc. Japan 41, 836 (1976).
[2] A. Bansil and S. Kaprzyk, unpublished.