



Experiment title: High resolution scattering study of the fermiology of high temperature superconductors $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$	Experiment number: HE-391	
Beamline: ID15B	Date of experiment: from: 15-Apr-98 15:00 to: 24-Apr-98 07:00	Date of report: 31-Aug-98
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Names and affiliations of applicants (* indicates experimentalists):

S. Manninen*, K. Hämäläinen* and J. Laukkanen*

Department of Physics, University of Helsinki

P.O.Box 9, FIN-000 14 University of Helsinki

A. Bansil

Department of Physics, Northeastern University

Boston, Massachusetts 02 115, USA

Report:

High resolution spectrometer at the beamline ID1 5B has been used to measure the momentum anisotropy of the high temperature superconductor $\text{La}_{1.85}\text{Sr}_{0.15}\text{CuO}_4$ (LSCO). The idea behind this project was work out how Compton scattering technique can be applied to study the basic properties like the Fermi surface of high temperature superconductors. Compared with alternative techniques like angle-resolved photoemission [1] and positron annihilation [2] the experimental problems are less severe (bulk information is obtained, method is not sensitive to lattice defects). On the other hand all electrons contribute to the measured cross section which means that extremely high statistical accuracy is required to separate the noninteresting core electron contribution from the measured data.

Single crystal LSCO samples were measured with the scattering vector along [001] and [100] directions using 55.9 keV x-rays. The resolution of the scanning focusing spectrometer at ID1 5B was about 0.15 a.u. Because of the scanning procedure the incident photon flux must be monitored. Both ion chamber in the incident beam and a solid state detector to measure the inelastically scattered intensity were used. Solid state detector data was also used as a low resolution (0.60 a.u.) reference to the high resolution results. The statistical accuracy of the spectrometer data was about 0.2 % at the Compton peak.

Figure 1 shows the experimental Compton profile anisotropy $J_{[001]} - J_{[100]}$ compared with the band structure calculation, based on a KKR-method. As can be seen the main features, predicted by theory can be seen in the experimental data but the anisotropy is smaller. The more detailed analysis of the results is in progress.

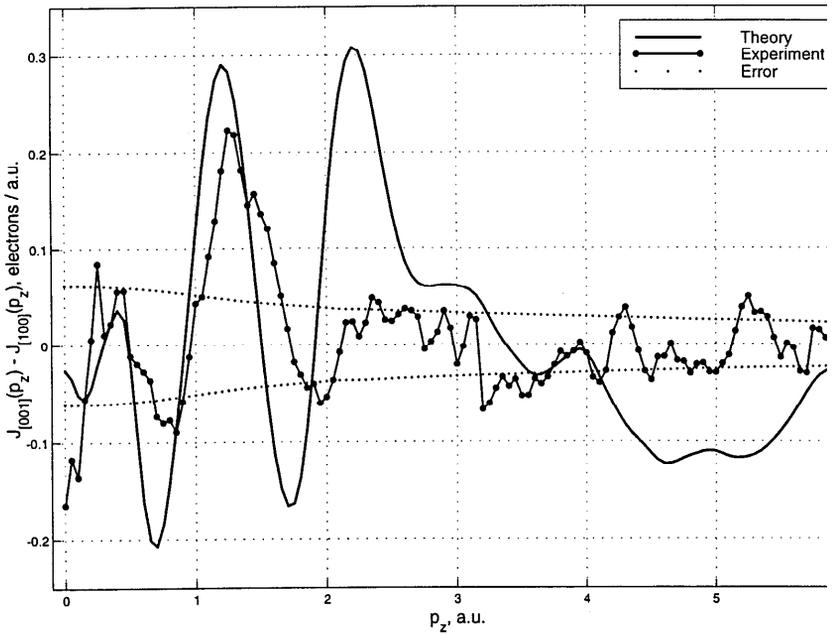


Figure 1. Experimental Compton profile anisotropy in $\text{La}_{1.85}\text{Sr}_{1.15}\text{CuO}_4$ (• • •). The solid line gives the m-theory, convoluted with the experimental resolution (0.15 a.u.). The statistical error is given by the dashed lines.

References:

- [1] J.C. Campuzano et al. Phys.Rev.Lett. **64**, 2308 (1990)
- [2] L. Hoffmann et al. Europhys.Lett. **6**, 66 1 (1988)