Observation of Anisotropic Magnetic Compton Profiles of hcp-Co

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Magnetic Compton scattering method informs us the magnetic electron momentum distribution projected to the x-ray scattering vector direction. An APW band calculation for magnetic Compton-profile (MCP) of hcp-Co was performed by S. Matsumoto et al. in 1993. They calculated MCPs along the [11$\bar{2}$0], [10$\bar{1}$0] and [0001] directions, and predicted the anisotropy arising from the crystal structure. In 1996, MCPs on single crystalline hcp-Co were measured by P. K. Lawson et al. at ESRF. and clear difference could not found between the [0001] and [10$\bar{1}$0] axis.

To clarify the discrepancy between the theoretical profiles and the ESRF report, we performed MCP measurements using two single crystals of hcp-Co (about 10mm ϕ × 2mm) : one has a plane normal to the [11$\bar{2}$0] axis, and the other normal to the [0001] axis. The incident energy of x-rays was 274keV with the degrees of circular polarization of Pc ≒0.6. The scattering angle was about 175 degrees. The momentum resolution was 0.64 a.u., which was mainly restricted by an energy resolution of a large volume Ge SSD (130cm^3). The sample was mounted in a 2.5T field generated by a superconducting magnet.

The results are shown in Figs. As seen in Fig.1, our result is good agreement with ESRF one. The theoretical profile deviates from the experiments on the central dip (near 0a.u.) and the tail above 3a.u. The experimental difference between the [11$\bar{2}$0] and [10$\bar{1}$0] axis is consistent with the theoretical one, but the experimental differences between the [10$\bar{1}$0] and [0001] etc. don't agree with the theoretical ones.

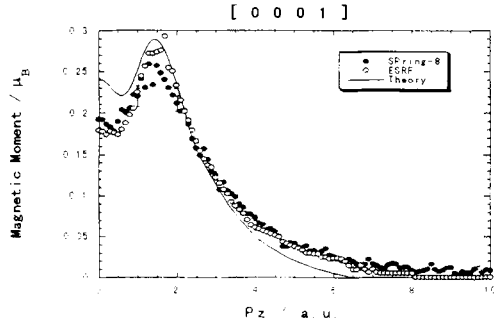

Figure.1 Magnetic Compton Profiles of hcp-Co.
Theory is convoluted with a Gaussian having a FWHM=0.64a.u.

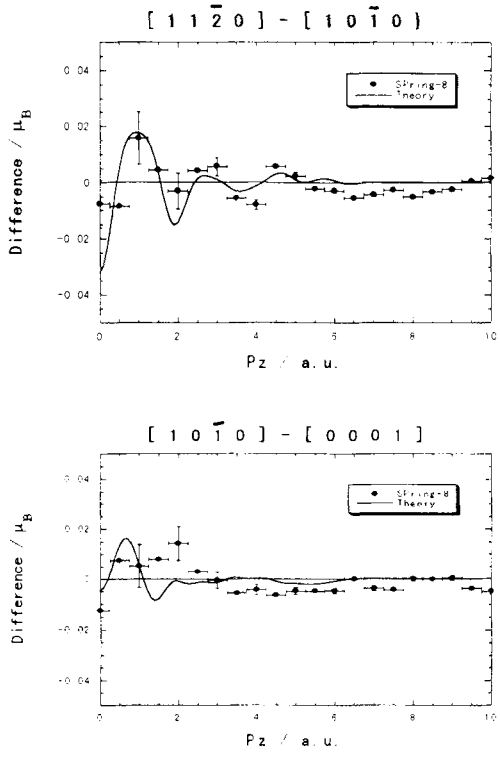

Figure.2 Subtract from two Magnetic Compton Profiles of hcp-Co