ESRF

Experiment title:

MAGNETIC COMPTON SCATTERING AT RELATIVISTIC ENERGIES

Experiment number:

HC474

Beamline:

Date of Experiment:

from: 4/6/96 to: 14/6/96

Date of Report:

29/8/96

Shifts:

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Received at ESRF

3 0 AUG 1996

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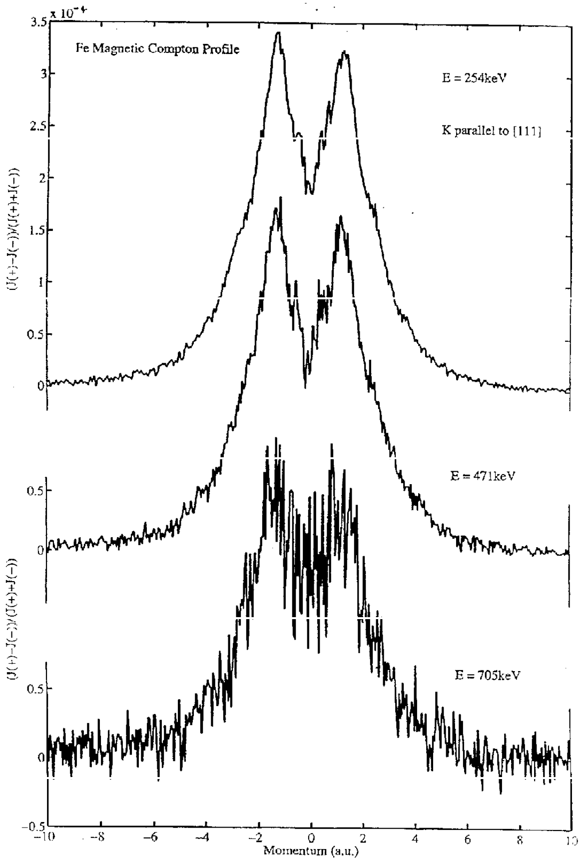
Report:

In magnetic Compton scattering studies in the second half of 1995 we used the asymmetric wiggler to extend magnetic Compton scattering studies from the "traditional" energy range of 50-70keV up to 256keV in order to determine the optimum conditions for further experimental work and to search for any evidence for departures from the cross-section which, for bound electrons, is developed for energies much less than mc^2 and ignores the pure magnetic scattering. We found no evidence for any deviation, but were able to record an improvement by a factor of two in the resolution at which these experiments can be performed with a semiconductor detector. That work is submitted for publication in J Synchrotrons Radiation.

In this experiment we were able to use the superconducting wavelength shifter to extend the energy range at which circular polarisation can be extracted, up 1 MeV. There was sufficient flux to record magnetic Compton profiles at 254, 471 and 705 keV, as can be seen in the accompanying figure, while at 1000.5 keV, which is approximately ten times the critical energy of the insertion device, the integrated intensity alone was measurable. The use of circularly polarised light produces an interference term between the charge and magnetic



scattering amplitudes which scales as K/mc, where K is the modulus of the scattering vector. In our previous studies with the asymmetric wiggler this scaling was observed, indicating that the pure magnetic scattering which has a relative amplitude of $(K/mc)^2$ was negligible. However in this experiment the magnetic effect, as a percentage of the charge scattering, appears to decline as the following table indicates:

E_i (keV)	% magnetic effect
245.2	2.6
471.3	2.8
704.7	1.9
1000.5	1.7

Given that the modelled polarisation predicts a slight rise, rather than fall in the degree of circular polarisation with energy, at first sight it appears that the charge scattering is being enhanced by pure magnetic scattering. The latter, being quadratic in the spin moment is not affected by the reversal of the sample magnetisation that is used to isolate the (first order) magnetic Compton profile. Further analysis of the spin up and spin down scattering is in progress to verify this. On the other hand the actual magnetic Compton profiles shown in the figure, have the same shape as each other and those measured at lower energies, indicating that the interptetative theory remains valid for energies beyond mc^2.