	Experiment title: Magnetic interaction between a 1 dimensional and 3 dimensional interpenetrating lattice	**Experiment number**: HE-823
Beamline: ID20	**Date of experiment**: from: 1-.6/6.10 to: 4.6./11.10	**Date of report**: 26.2.01
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Report:

Copper-oxide compounds with half-integer (S=1/2) Cu^{2+} spins and strong antiferromagnetic interactions exhibit new phenomena due to quantum fluctuations as spin-Peierls transitions or high-T_c super-conductivity. One of the most striking features is that in the presence of important magneto-elastic coupling as e.g. found in 1 dimensional chain or ladder systems, magnetism is connected with structural dimerization. Recently, we have investigated a new cuprate CuB_2O_4 using magnetic susceptibility, specific heat and muon spin rotation [1]. More recently, our neutron scattering results showed that there are 2 magnetic phase transitions at 20 K into a commensurate antiferromagnet (AF) and at 10 K, into an incommensurate (IC) phase. The observation of higher order satellites close to the AF/IC phase boundary showed that CuB_2O_4 exhibit the first 3 dimensional magnetic soliton lattice in zero magnetic fields [2].

The experiments failed to detect a magnetic signal in the commensurate phase (first part of the experiment), between 10 and 20K. The huge anisotropy due to a single

local bond perpendicular to the chain direction leads to very strong Templeton & Templeton scattering. Fig. 1 shows an energy dependence of the [5 5 0] reflection for σ–π polarization.

The non-resonant X-ray scattering experiments show a different temperature dependence of the magnetic intensities in the (7 7 δ) satellites for π-π and π-σ polarization in the incommensurate phase (see Fig. 2). This can be interpreted in terms of a change of the direction of magnetic moments with decreasing temperature in the incommensurate phase. Further studies of the magnetic excitations in the incommensurate magnetic phase, as well as improved data analysis, is in progress.

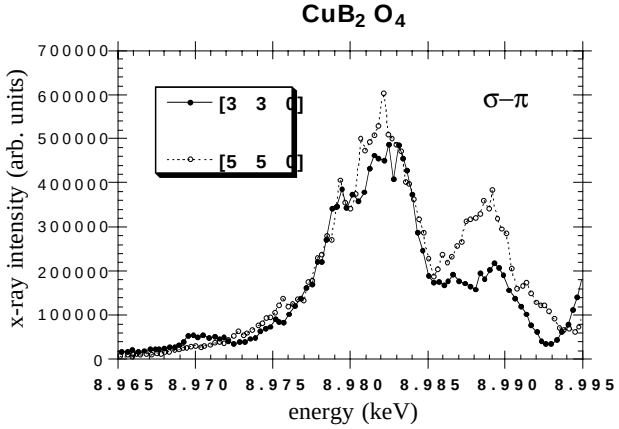

Fig. 1 Energy scan of the [5 5 0] reflection at T=12K of CuB_2O_4 (charge forbidden).

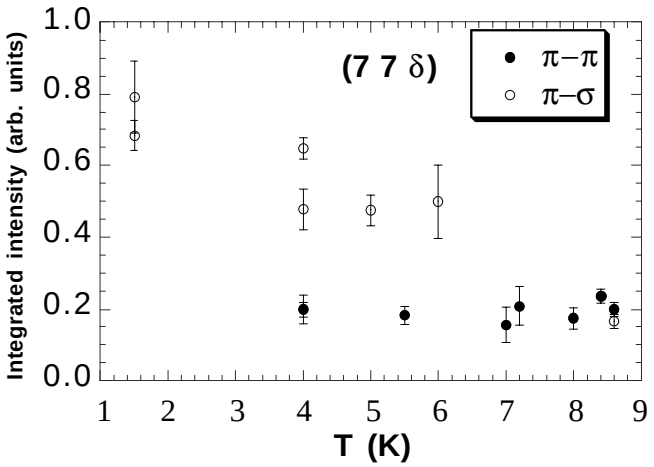

Fig. 2: Integrated non-resonant X-ray intensities of the (7 7 δ) magnetic satellite reflection for different scattered polarizations.

[1] G. Petrakovskii, D. Velikaniv, A. Vorotinov, A. Balaev, K. Sablina, A. Amato, B. Roessli, J. Schefer, and U. Staub, J. Mag. Mag. Mat. **205**, 105 (1999).
[2] B. Roessli, J. Schefer, G. Petrakovskii, B. Ouladdiaf, M. Boehm, U. Staub, A. Vorotinov, and L. Bezmaternikh, Phys. Rev. Lett., **86**, 1885 (2001).