ESRF	**Experiment title:** X-ray study of one-dimensional fluctuations in the spin-Peierls compound CuGeO3	**Experiment number**: 02-02-175
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Report:

The purpose of the experiment was to measure the high temperature regime of fluctuations of the spin-Peierls transition in $CuGeO_3$. At T_{SP}=14.3 K the system undergoes a spin-Peierls transition, revealed by the appearance of very weak intensity satellite reflections at the (½, 0, ½) reduced wave vector (~10^{-5} the average Bragg intensity).

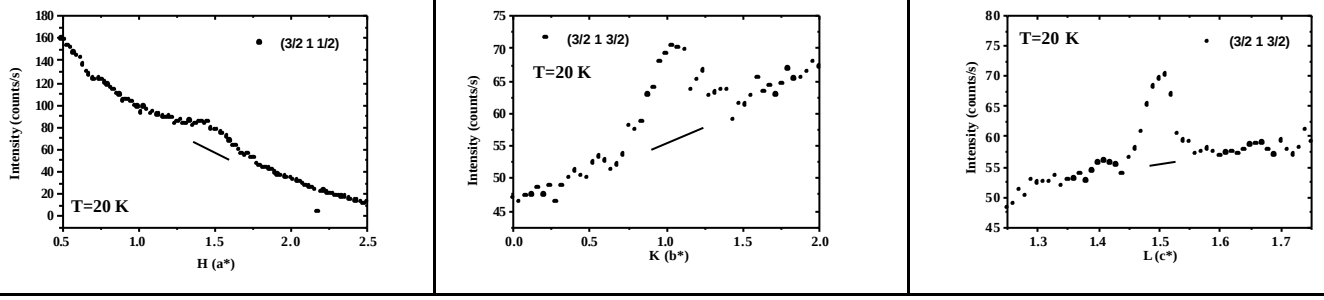

Figure 1 : Scans along the chain (c^*), interchain (b^*) and interlayer directions (a^*).

We have studied a sample of (0.1 x 2 x 4) mm^3 with an x-ray energy of 8 keV. Very weak diffuse scattering at the (3/2, 1, ½) and (3/2, 1, 3/2) reciprocal position were measured from ~20 K, the lowest temperature of the experimental setup, up to ~36 K, the temperature above which the signal was almost impossible to extract from the background. The diffuse scattering

were scanned along the three main directions of the crystal : along the chain (a direction) and in the transverse b and c directions. Due to the large width of the diffuse scattering, the fits of the peaks were performed with a Lorentzian line shape without applying any deconvolution procedure. Typical scans at T=20 K are indicated in figure 1.

The correlation lengths obtained are displayed on Fig. 2, and are clearly consistent with those obtained near T_{SP} by Wang *et al.* [1] and Lorenzo *et al.* [2].

Following a classical analysis of the data, a dimensional crossover is defined as the temperature where a given correlation length reaches the value corresponding to the distance between spins along this particular direction. Considering that the spin-spin distance is b/2 along the b direction, the 2D-1D crossover is found at 24 K, while the 3D-2D crossover is found at 16 K from previous measurements. Thus, a sizeable regime of 1D structural fluctuations takes place above 24 K, which is expected as the SP instability is triggered by 1D AF fluctuations. This experiment clearly rules out a mean-field behavior of the transition. The results of this experiment have been presented at the conference "Quantum Properties of Low-Dimensional Antiferromagnets" in Fukuoka (Japan) [3].

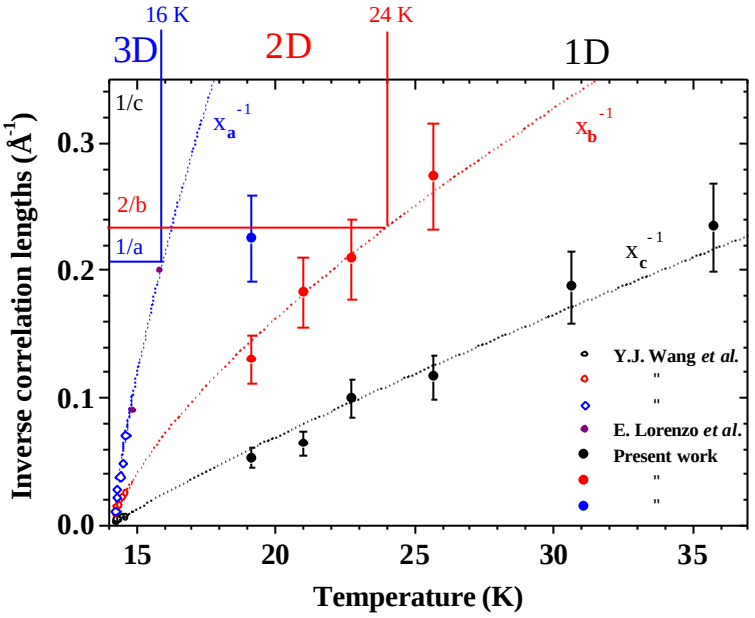

Fig. 2: Thermal dependence of the inverse correlation lengths in the **a**, **b**, and **c** (chain) directions of $CuGeO_3$. The inverse interchain distance 1/a and 2/b are indicated, together with the crossover temperatures.

[1]- Y.J. Wang, Y.-J. Kim, R.J. Christianson, S.C. LaMarra, F.C. Chou and R.J. Birgeneau, Phys. Rev. B **63**, 052502 (2001)

[2]- J.E. Lorenzo, L.P. Regnault, S. Langridge, C. Vettier, C. Sutter, G. Grübel, J. Souletie, J.G. Lussier, J.P. Schoeffel, J.P. Pouget, A. Stunault, D. Wermeille, G. Dhalenne and A. Revcolevchi, Europhys. Lett., **45**, 45 (1999).

[3]- S. Ravy, J.-P. Pouget, S. Grenier, A. Toader, J.E. Lorenzo, Y. Joly, H. Renevier, B. Grenier, J.Y. Henry, L.-P. Regnault, J. Jegoudez, G. Dhalenne and A. Revcolevschi, proceedings of the conference "Quantum Properties of Low-Dimensional Antiferromagnets", Fukuoka (Kyushu University, Japan) November, 20-22, 2001.