SANS and μSR Studies on the New "*B-Phase*" at Low Temperatures in MnSi

M. Pardo-Sainz[2,1], M. Ohkuma[3], M. Mito[3], K. Ohishi[4], Y. Kousaka[2], K. M. Kojima[5], M.-V. de Toro Sanchez[5], K. Inoue[6,7], V. Laliena[8] J. Campo[1,*]

[1]*Instituto de Nanociencia y Materiales de Aragón (CSIC-Universidad de Zaragoza),* [2]*Osaka Metropolitan University,* [3]*Kyushu Institute of Technology,* [4]*Comprehensive Research Organization for Science and Society,* [5]*TRIUMF,* [6]*Hiroshima University,* [7]*Chirality Research Center and Institute for Advanced Materials Research,* [8]*Universidad de Zaragoza*

Recently, we suggested theoretically that at low T, the conical (CH) and forced-ferromagnetic (FFM) phases in cubic helimagnets are not connected but are separated by another Skyrmion Lattice phase (SkL), which could be metastable, and a new phase of "unknown" nature just below the critical field Hc at low T [1]. The theoretical prediction of the new SkL phase at low T is in good agreement with the experiments reported in [2,3]. On the other hand, by using careful AC susceptibility at low temperature, we determined the magnetic phase diagrams of oriented enantiopure single crystals of MnSi [4] in which a new phase (*B-phase*) emerges, which could be consistent with the theoretical prediction for the new "unknown" low temperature phase.

In order to clarify the nature of this *B-phase* at low T near critical field, we performed Small Angle Neutron Scattering (SANS) measurements at TAIKAN in J-PARC and muon spin rotation (μSR) measurements at M15 in TRIUMF. The magnetic field dependence of the SANS patterns at 2 K and both 0.3 T and 0.5 T show two peaks along the horizontal axis for $\vec{H} \perp \vec{k_\iota}$ ($\vec{k_\iota}$ incoming neutron beam wave vector). These are the magnetic Bragg peaks of the conical state. On the other hand, no diffraction peaks were observed for $\vec{H} \parallel \vec{k_\iota}$, in which, for example, a six-fold-symmetric diffraction pattern is observed in typical SkL (*A-phase*). These results suggest that the CH phase which exists in *B-phase* is different from the *A-phase* near T_C. According to the μSR results, the internal magnetic field distribution in *B-phase* is apparently different from that in CH at low fields and FFM phases, consistent with the SANS results.

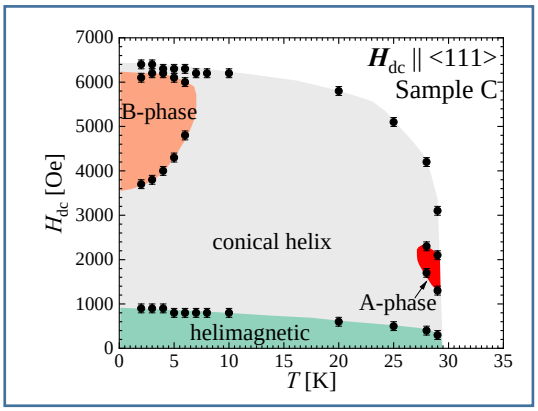

Fig. 1. Magnetic phase diagram of MnSi for the magnetic field applied along <111>.

In the presentation, we will talk about the results of both SANS and μSR in detail, and discuss a possible spin texture in the new *B-phase*.

References

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