

# A New Magnetic State, “B-Phase”, in MnSi Probed by SANS and $\mu$ SR

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## Abstract

The chiral helimagnetic structures, forming only one-handed screw magnetic structures, have attracted attention because of the emergence of unique topological magnetic textures such as magnetic skyrmion lattices (SkL) [1] and chiral magnetic soliton lattices [2]. 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 SkL, which could be metastable, and a new phase of “*unknown nature*” just below the critical field  $H_c$  at low T [3].

Using careful ac magnetization measurements at low temperature, we determined the magnetic phase diagrams of oriented crystals of MnSi [4]. It is consistent with the theoretical prediction for the new “*unknown*” low temperature phase.

In order to clarify the nature of this new phase at low T near critical field, we performed small-angle neutron scattering (SANS) measurements at TAIKAN in J-PARC and muon spin rotation ( $\mu$ SR) measurements at M15 in TRIUMF. Figure 1 shows the magnetic field dependence of the SANS patterns at 2 K [5]. At both 0.3 T (CH phase) and 0.5 T (B-phase), the SANS patterns show two peaks along the horizontal axis in Fig. 1(a) and (b) for  $H \perp$  in coming neutron beam wave vector  $k_i$ . These are the magnetic Bragg peaks of the conical state. On the other hand, as shown in Fig. 1(c) and (d), no diffraction peaks were observed for  $H \parallel k_i$ , in which, for example, a six-fold-symmetric diffraction pattern due to a formation of SkL is observed in A-phase (SkL). These results suggest the CH phase exists in B-phase and B-phase is different from A-phase near  $T_c$ . According to the  $\mu$ SR results, we found the internal magnetic field distribution in B-phase is apparently different from that in CH and FFM phases, consistent with the SANS results.

In the presentation, we will talk about the results of both SANS and  $\mu$ SR in detail, and discuss a spin texture in the B-phase.

## References

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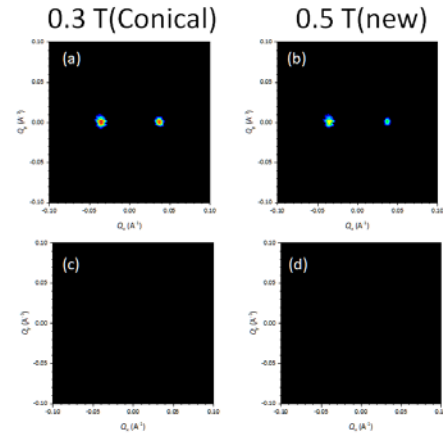


Fig. 1.  $H$  dependence of the SANS patterns at 2 K (a,b) with the condition of  $H \parallel [111] \perp k_i$ , and (c,d) that of  $H \parallel [111] \parallel k_i$  [7].