Static magnetic order in metallic triangular antiferromagnet Ag_2MnO_2

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Layered transition-metal dioxides AMO_2, which consist of alternating stacks of A and MO_2 planes, where A^+ stands for an alkali (Li^+, Na^+, K^+, Rb^+, and Cs^+), Ag^+, or $(Ag_2)^+$ ion and M^{3+} for a transition metal ion, and in which M ions form a two-dimensional (2D) triangular lattice by connection of edge-sharing MO_6 octahedra, have been heavily investigated due to their complex magnetic behavior [1] and a discovery of superconductivity in $Na_xCoO_2{*}1.3H_2O$. Although the 2D interaction is thought to play an essential role for determining the magnetic nature of AMO_2, the inter-plane (3D) interaction sometimes contributes to form long-trange order in the AMO_2 compounds.

In order to reduce the 3D interaction and to make AMO_2 close to an ideal 2D system, one could increase the inter-plane distance ($d_{\rm IP}$) of AMO_2 by using A ions with larger ionic radius; in particular, the largest $d_{\rm IP}$ is achieved for A=Ag_2 for AMO_2. Furthermore, metallic conduction in the Ag_2 plane [2] naturally hinders the interaction between the adjacent MO_2 planes, i.e., the 3D interaction via the Ag_2 plane. This implies that Ag_2MO_2 is most likely to be a candidate for an ideal 2D triangular lattice system. However, among several combinations between Ag_2 and M for AMO_2, only Ag_2NiO_2 and Ag_2MnO_2 have been prepared thus far.

Following upon the experiment on Ag_2NiO_2 [3], we have hence extended our μ^+SR experiments to Ag_2MnO_2. The wTF- and ZF-measurements using a powder sample of Ag_2MnO_2 have demonstrated the existence of a static antiferromagnetic (AF) order below $T_N^{\rm end}$=30 K, while short-range order appears below $T_N^{\rm on}$=80 K. The strongly damped oscillatory signal in the ZF-spectrum, however, indicates a wide field distribution at the muon sites even at 1.8 K due to the geometrical frustration of the triangular lattice. Although the AF spin structure is still unknown, further studies of the magnetic properties of the MnO_2 plane, particularly the ground state of the AF phase should yield significant new information on the physics of these unique frustrated systems.

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