Spin Disordered State in the Quasi-Two-Dimensional Triangular Antiferromagnet $NiGa_2S_4$

Y. Nambu,[1] K. Onuma,[1] S. Nakatsuji,[1,2] and Y. Maeno[1]

[1]*Department of Physics, Kyoto University, Kyoto 606-8502, Japan.*
[2]*Institute for Solid State Physics, University of Tokyo, Kashiwa 277-8581, Japan.*

Recently, a quasi-two-dimensional (2D) $S = 1$ triangular antiferromagnet (AFM) $NiGa_2S_4$ has been discovered as the first example of a bulk low-spin AFM on an exact triangular lattice [1]. Despite antiferromagnetic interactions of 80 K, neither long-range order nor conventional spin glass ordering has been detected down to 0.35 K. Instead several diffraction measurements show the formation of a gapless spin disordered state at low temperatures. In Zn substituted compounds, the robust low-temperature behavior, i.e., the constant susceptibility, the T^2-dependent specific heat, and their scaling behavior with the Weiss temperature (FIG.1) indicates the existence of the Goldstone mode of the gapless linearly dispersive type. The absence of either conventional magnetic order or conventional spin glass ordering suggests that the ground state has a novel symmetry breaking in 2D [2]. In this talk, the fundamental features of $NiGa_2S_4$ will be firstly reviewed. Then, we will introduce recent results of nonmagnetic/magnetic impurity effects, magnetic properties of single crystals and dependence on sulfur stoichiometry.

[1] S. Nakatsuji, Y. Nambu *et al.*, *Science* **309**, 1697 (2005).
[2] Y. Nambu *et al.*, J. Phys. Soc. Jpn. **75**, 043711 (2006).

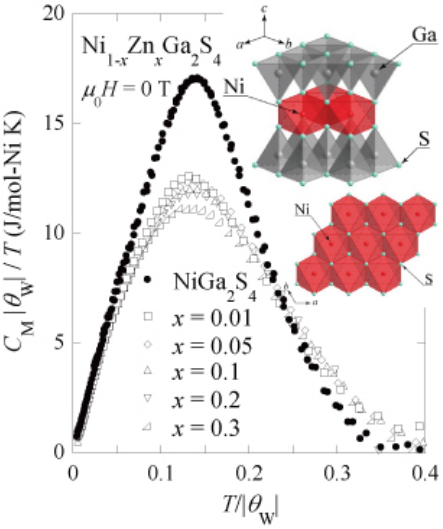

FIG.1: Temperature dependence of the magnetic specific heat in Zn substituted compounds and the crystal structure of $NiGa_2S_4$.