Thermodynamics of an S=1/2 Heisenberg Antiferromagnet

T. Hong (ORNL); C.P. Aoyama and Y. Takano (UF, Physics)

Introduction

The quantum phase transition (QPT) has been a long studied fundamental issue in which physicists have honed our understanding of the universality of quantum critical behavior in many-body systems [1]. The spin-1/2 Heisenberg antiferromangets have the potential to exhibit quantum critical phenomena as the applied magnetic field is varied. For instance, in our previous study on such a material, $(C_7H_{10}N)_2CuBr_4$ (DIMPY for short), long range magnetic ordering (LRO) due to weak inter-ladder couplings, also known as a Bose-Einstein condensation (BEC) of magnons [2], is revealed at temperatures up to 340 mK and fields above the critical field $H_c \approx 3.0$ [3].

Another S=1/2 organic-metallic compound, $C_9H_{18}N_2CuBr_4$ (DMA for short), has been proposed recently [4]. Based on the crystal structure, the material is suggested to be a two-leg spin ladder with the ladder direction along the crystallographic **b** axis [4]. Susceptibility data are well described as an antiferromagnetic Heisenberg two-leg ladder model with the exchange constants J_{rail}=7.95 K and J_{rung} 4.07 K [4].

Experimental

We performed the specific heat and magnetization measurements on a deuterated single-crystalline DMA sample at SCM1 at temperatures down to 0.1 K and the magnetic fields up to 18 T.

Results and Discussion

A QPT from a quantum disordered state to an LRO state was revealed in DMA, and the field dependence was measured. We plan to map out the *H-T* phase diagram from the specific heat and magnetization data.

Conclusions

We studied the quantum critical behavior by thermodynamics in the new S=1/2 compound DMA. The data analysis is undergoing, and we will soon write a paper to report our findings.

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