Spin Freezing of the 2D Stacked Triangular Antiferromagnet $Ba_3RuTi_2O_9$

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Introduction

Two-dimensional triangular antiferromagnets have proven to be a rich templates for exploring quantum spin liquids. To date, only handful of spin systems, for example, κ-$(BEDT\text{-}TTF)_2Cu_2(CN)_3$, $Et_nMe_{4-n}Sb[Pd(DMIT)_2]_2$, and $ZnCu_3(OH)_6Cl_2$ have been discussed in the context of a spin liquid physics [1-3]. The most recent advances in this field have been ignited by the discovery of the 6H-perovskite family $Ba_3MSb_2O_9$ (M=Cu, Ni) and $Ba_3MTi_2O_9$ (M=Ru, Ir), which realize stacked triangular antiferromagnets [4-6]. The nice thing is that these compounds host a diverse library of chemical variants. S=1/2 $Ba_3CuSb_2O_9$ has a random singlet state while S=1 $Ba_3NiSb_2O_9$ is regarded as a spin liquid candidate. The related issue is on a ground state of the *4d* sister compound $Ba_3RuTi_2O_9$ (4d; S=1) and effects of spin-orbit coupling and disorders on a spin liquid state. In this study, we employ ac susceptibility as a probe for slow spin dynamics.
ac susceptibility measurements were performed using an in-house developed susceptometer in SCM1 at temperatures from 30 mK to 300 mK and at fields of *H*=0 - 0.08 T.

Results and Discussion

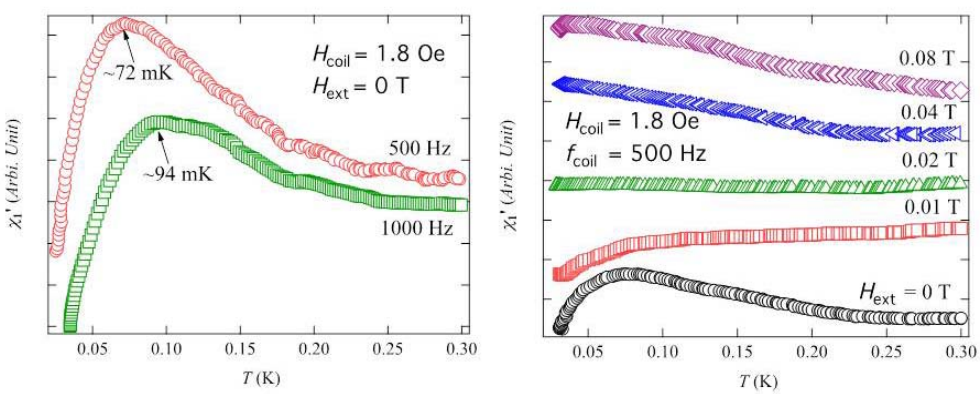

Fig. 1 (Left panel) Temperature dependence of the real part of the ac susceptibility measured at frequencies ν=500 and 1000 Hz without external dc field. (Right panel) Temperature dependence of the real part of the ac susceptibility at various fields of *H*=0 - 0.08 T.

In Fig. 1 we summarize the temperature dependence of the ac susceptibility recorded at zero dc magnetic field. Upon cooling, the real part of the ac susceptibility at ν=500 Hz shows a broad peak at about 72 mK. With increasing frequency, the peak shifts to higher temperature and is reduced in amplitude. The imaginary part of the ac susceptibility shows weak frequency dependence. This peak is related to spin freezing. When an external dc field is turned on, the peak is significantly suppressed and hence is not discernible for fields above 0.02 T. This lends further support for the formation of a spin-freezing state. A random site disorder between Ti^{4+} and Ru^{4+} ions may be responsible for this.

Acknowledgements

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