Exploration of Heisenberg Antiferromagnet on a Triangular Lattice

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Introduction

The triangular lattice is one of the prototypical geometries for frustration in antiferromagnets. But spin- 1/2 antiferromagnets on isotropic triangular lattices, where the interplay between geometric frustration and quantum fluctuations is most pronounced, are rare. $YbMgGaO_4$, one of the rare cases, has recently attracted much attention as a candidate for a spin liquid [1−4]. $Sr_{21}Bi_8Cu_2(CO_3)_2O_{41}$ is a new member of this small club [5]. However, very little is known about the magnetic property of this material other than the Curie-Weiss temperature, Θ = −28 K [2]. If interlayer exchange is ignored, this Θ implies an intralayer exchange of 19 K, with a corresponding saturation field as high as 63 T.

Experimental

With the vibrating sample magnetometer at the NHMFL DC-Field Facility, we have measured the magnetization of a $Sr_{21}Bi_8Cu_2(CO_3)_2O_{41}$ sample, in magnetic fields up to 35 T. The experiment was cooled with a ^{3}He Inserts, but the minimum stable temperature was 1.8 K.

Results and Discussion

As shown in Fig. 1, the magnetization rises quickly to roughly 2/3 of the expected saturation magnetization and stays constant at that value from about 13 T all the way up to 35 T, the maximum field of the experiment.

Conclusions

There is no evidence in the data for a magnetization plateau, the hallmark of the Heisenberg antiferromagnet on the triangular lattice. This surprising result begs for further studies of this new material.

Acknowledgements

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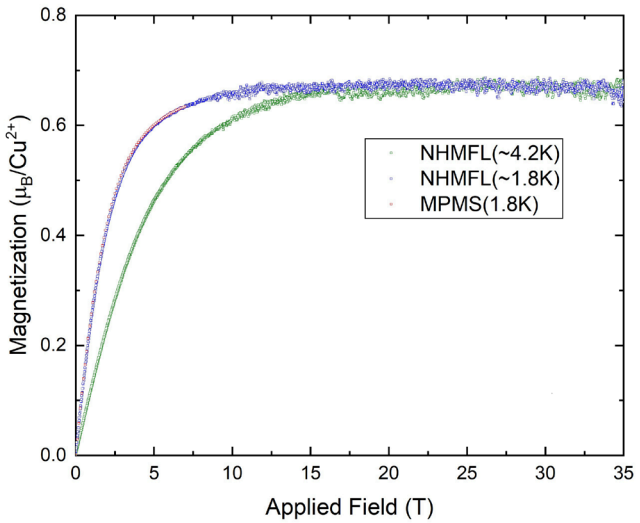

Fig.1 Magnetization of $Sr_{21}Bi_8Cu_2(CO_3)_2O_{41}$ measured with a vibrating sample magnetometer at the Mag Lab DC Field Facility (labeled NHMFL) and with a commercial SQUID magnetometer (labeled MPMS).

References

[1] Y. Li *et al*., Sci. Rep. **5**, 16419 (2015).
[2] Y. Li et al., Phys. Rev. Lett. **115**, 167203 (2015).
[3] Y. Li *et al*., Phys. Rev. Lett. **117**, 097201 (2016).
[4] Y. Xu et al., Phys. Rev. Lett. **117**, 267202 (2016).
[5] S. Malo et al., Inorg. Chem. **54**, 10266 (2014).