EPR Study of the Spin-1/2 Kagome Antiferromagnet $ZnCu_3(OH)_6Cl_2$

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Introduction

A quest of finding the first experimental realization of a pure spin-1/2 Heisenberg kagomé anfiferromagnet, potentially displaying a resonating-valence-bond ground state [1], has recently resulted in the synthesis of $ZnCu_3(OH)_6Cl_2$ [2]. Experimentally, a disordered strongly fluctuating state has been observed down to 50 mK (~J/300) [3]. However, bulk susceptibility displayed a monotonic increase with decreasing temperature [4], unexpected for a singlet ground state. Questions were raised in literature to what extent this was due to impurities and magnetic anisotropy [4].

Results and Discussion

Using EPR, we have directly probed magnetic moments of intrinsic Cu^{2+} and impurities. EPR also yielded information about the magnetic anisotropy through the spectral line-widths [5]. These were fitted to a powder-distributed Lorentzian line-shape. The EPR intensity [Fig. 1(a)] displays the same *T*-dependence as the bulk susceptibility, indicating that both the intrinsic Cu^{2+} moments on kagomé lattice and "impurity" Cu^{2+} moments due to Cu^{2+}/Zn^{2+} inter-site exchange contribute to the single EPR line. Similar conclusion can be deduced from a peak in the EPR line-width (component perpendicular to kagomé planes) around 50 K [Fig. 1(b)].

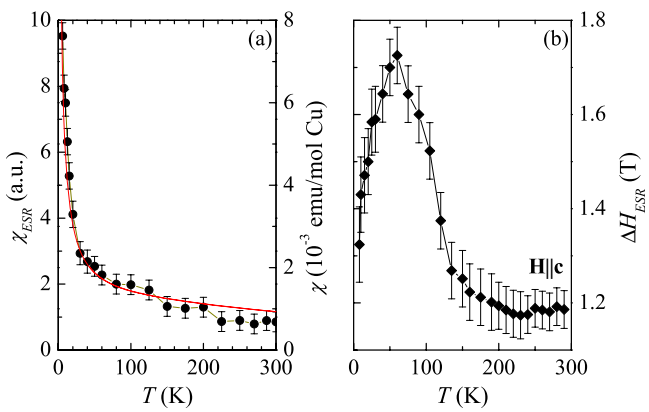

Figure 1: *T*-dependence of the EPR (a) intensity and (b) line-width measured at 326.4 GHZ on powder $ZnCu_3(OH)_6Cl_2$.

Conclusions

At low-*T* (high-*T*) an impurity (intrinsic kagomé) contribution dominates the EPR spectra. The corresponding high-*T* line-width yields information about the dominant intrinsic anisotropy term (Dzyaloshinsky-Moriya) present in the system [5].

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References

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