Search for Exotic Phases in the Parameter Space of a Kitaev Heisenberg Model

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Introduction

There has been signficant experimental and theoretical activity to understand the properties of the quantum magnet Na_2IrO_3 with a honeycomb lattice, which is believed to be an experimental realization of the celebrated Kitaev Heisenberg model. In this case the magnetic structure is highly frustrated with a Curie Weiss temperature of -116K and T_N= 15K leading to a frustration index ~ 8 [1]. Neutron and x-ray scattering experiments have confirmed that the system has a zig-zag magnetically ordered structure in its ground state [2]. While the observation at magnetic order indicates a finite Heisenberg term, experimental evidence pertaining to the relative contribution of the Kitaev and Heisenberg terms in the total Hamiltonian is lacking. Theoretical studies suggest that a topological phase expected from the Kitaev interaction may be observed in an applied magnetic field. Our measurements of the high field magnetisation of Na_2IrO_3 are designed to search for experimental manifestations of the Kitaev interaction.

Experimental

The Na_2IrO_3 crystal used for the high field measurement was grown by the flux method and characterized using SEM, magnetization and resistivity measurements. Measurements were done in Cell 12 using a He3 cryostat up to 35T. Capacitance measurements were done using an AC Capacitance bridge with a driving frequency of 1kHz and Cu-Be cantilevers of 25 and 60 micron thickness. The cantilever was mounted on a G10 bucket holder capable of being rotated from the top of the probe. Magnetic field sweeps were made at the base temperature (350mK) for various angles in the angular range between 8^0 and -58^0.

Results and Discussion

The torque responses for various angular positions at the base temperature are shown in **Figure1**. A comparison is currently underway with numerical calculations of the Kitaev Heisenberg model.

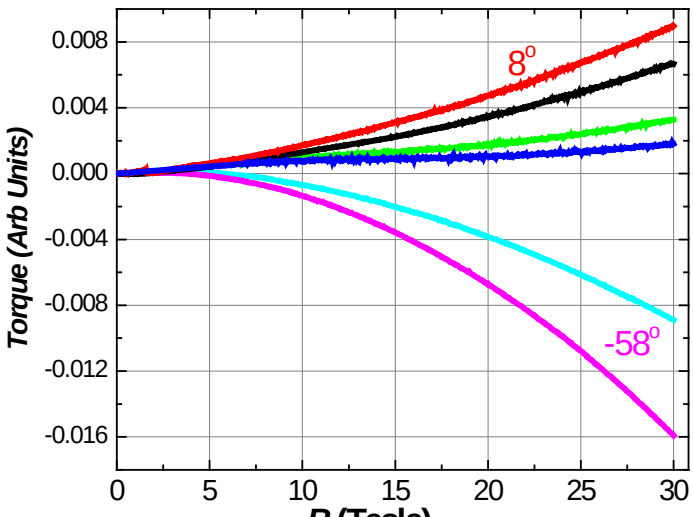

Figure.1

Acknowledgements

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References

[1] Singh Y., *et al*., arXiv:1006.0437 (2010).
[2] Choi S.K., *et al*., arXiv:1202.1268 (2012).
[3] Jiang H.C., *et al*., arXiv:1101.1145 (2011).