

CMP Seminar Michigan State University

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From Neutrons to Nanoscience in the layered magnets α -RuCl₃ and Cr_{1/3}NbS₂

Recent advances in the preparation and handling of 2D exfoliated flakes and van der Waals heterostructures has created exciting opportunities to cross-fertilize the fields of nanoscience and bulk quantum materials. Both α -RuCl₃ and Cr_{1/3}NbS₂ are excellent examples of the possibilities inherent in this approach. In this talk I will discuss some recent neutron scattering results on single-crystal α -RuCl₃ that show features consistent with scattering from Majorana excitations of a Kitaev quantum spin liquid. I will also discuss some early results on the nanoscience of atomically thin flakes of α -RuCl₃. Cr_{1/3}NbS₂ orders magnetically into a helimagnetic ground state with a period of about 48 nm and with T_c = 130 K. The spins are arranged ferromagnetically in the ab-plane and the helix is along the c axis. The effect of an applied magnetic field in the ab-plane has been found to destabilize the helical structure gradually into a soliton lattice, a nonlinear periodic magnetic state, with an eventual incommensurate-to-commensurate transition into a ferromagnetic state at the critical field of 2300 Oe. Manipulation of the spin spiral with magnetic field has generated interest in this material for spintronics applications. In this talk I will discuss recent transport, thermodynamic, and neutron scattering measurements on this material, with particular emphasis on some recent results on nanoflakes.

A. Banerjee, C.A. Bridges, J.-Q. Yan, A.A. Aczel, L. Li, M.B. Stone, G.E. Granroth, M.D. Lumsden, Y. Yiu, J. Knolle, S. Bhattacharjee, D.L. Kovrizhin, R. Moessner, D.A. Tennant, D.G. Mandrus, and S.E. Nagler, Nat. Mater. **15**, 733 (2016).

A. Banerjee, J. Yan, J. Knolle, C.A. Bridges, M.B. Stone, M.D. Lumsden, D.G. Mandrus, D.A. Tennant, R. Moessner, and S.E. Nagler, Science **356**, 1055 (2017).

L. Wang, N. Chepiga, D.-K. Ki, L. Li, F. Li, W. Zhu, Y. Kato, O.S. Ovchinnikova, F. Mila, I. Martin, D. Mandrus, and A.F. Morpurgo, Phys. Rev. Lett. **118**, 257203 (2017).

Monday, November 20, 2017

4:10 p.m.

BPS 1400

Prof. Xianglin Ke - Host