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Magnetic and Crystal Structure of α -RuCl₃

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The layered honeycomb material α -RuCl₃ has been proposed as a candidate material to show significant bond-dependent Kitaev type interactions [1]. This has prompted several recent studies of magnetism in this material that have found evidence for multiple magnetic transitions in the temperature range of 8-14 K [2,3,4]. We will present elastic neutron scattering measurements collected using a co-aligned array of α -RuCl₃ crystals, identifying zigzag magnetic order within the honeycomb planes with an ordering temperature of \sim 8 K [2]. It has been reported that the ordering temperature depends on the *c* axis periodicity of the layered structure, with ordering temperatures of 8 and 14 K for three and two-layer periodicity respectively [3]. While the in-plane magnetic order has been identified, it is clear that a complete understanding of magnetic ordering and interactions will depend on the three dimensional structure of the crystal. Evidence of a structural transition at \sim 150 K has been reported [4] and questions remain about the structural details, in particular the stacking of the honeycomb layers. We will present x-ray diffraction measurements investigating the low and high temperature structures and stacking disorder in α -RuCl₃. Finally, we will present inelastic neutron scattering measurements of magnetic excitations in this material.

Work done in collaboration with K. W. Plumb (Johns Hopkins University), J. P. Clancy, Young-June Kim (University of Toronto), J. Britten (McMaster University), Yu-Sheng Chen (Argonne National Laboratory), Y. Qiu, Y. Zhao, D. Parshall, and J. W. Lynn (NCNR).

[1] K. W. Plumb et al., Phys. Rev. B 90, 041112(R) (2014).

[2] J. A. Sears et al., Phys. Rev. B 91, 144420 (2015).

[3] A. Banerjee et al., arXiv:1504.08037 (2015).

[4] Y. Kubota et al., Phys. Rev. B 91, 094422 (2015).