

Long and Short Range Magnetic order in the Spinel

Co₂Ru_{1-x}Mn_xO₄

G. Granroth^{1,2}, D. Mandrus², V. Keppens³ and S. E. Nagler²

¹Spallation Neutron Source, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831; ²Condensed Matter Sciences Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831; ³ Department of Physics, The University of Mississippi, Oxford, MS 38677.

Recent interest in magnetic spinels has focused on the frustrated pyrochlore lattice of the octahedral (B) sites[1]. However the tetrahedral (A) sites in this structure can also be populated with magnetic ions. If both sites are populated with magnetic ions, a variety of interesting magnetic states are observed. The A sites in the system Co₂Ru_{1-x}Mn_xO₄ are populated with Co²⁺ (high spin, S = 3/2), 1/2 the B sites are populated with Co³⁺ (low spin, S = 0) and the other 1/2 of the B sites are populated according to x with either Ru³⁺ (S = 1/2) or Mn³⁺ (S = 2). This system has strong A-A interactions and the strength of the A-B and B-B interactions are tuned by the value of x . We have performed neutron scattering measurements for T = 13 - 300 K to investigate the magnetic order in this system. At low temperatures, these measurements have revealed several combinations of long and short range magnetic order as a function of x . This behavior is bounded by short range A-A antiferromagnetic order with some spin glass like features at $x = 0$ and long range A-B ferrimagnetic order at $x = 1$. This contribution will discuss the three competing interactions as illuminated by these neutron measurements and previous bulk magnetization measurements[2].

[1] S.-H. Lee et al. Nature 418 (2002) 856

[2] D. Mandrus et al. Mat. Res. Bull. 34 (1999) 1013