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Investigating Long-range Magnetic Ordering in Li3Co2SbO6 a layered oxide honeycomb lattice

Over the last decade layered-honeycomb oxides have come to increasing prominence as materials that exhibit an array of interesting properties, including use as electrodes for Li-ion batteries, high electrical conductivity, low temperature magnetic phases, and spin-glass transitions. Layered oxides with the general formula AxM2XO6 (A = Li, Na; M = transition metals eg. Co, Cu, Ni; X = Bi, Sb, Te; $0 \leq x \leq 3$) are a form of 'honeycomb' lattice where one third of the transition metal sites are doped with high charge cations such as Sb5+ and Te6+. More recently honeycomb lattices have been investigated as Kitaev lattices and potential Quantum Spin Liquids (QSL).(1)

My project involves the conventional solid-state synthesis of Li3Co2SbO6 and the Na3-xLixCo2SbO6 solid solution. The focus is on investigating the magnetic behaviour of these systems, including antiferromagnetism below the Néel temperature(TN) and magnetic frustration within the 2D honeycomb layers. In addition, the Na analogue Na3Co2SbO6, possible QSL properties, as: is predicted to be a material which is a QSL.

Low-temperature neutron powder diffraction provides the means to investigate the structure of these materials and the magnetic lattice below TN. The spins are predicted to align in an antiferromagnetic 'zig-zag' arrangement.(2) Inelastic neutron scattering provides a means to verify if these materials do in fact become the unusual QSL as some have predicted.

References:

1. Banerjee, A., Bridges, C., Nagler, S., et al. (2016). Nature Materials, 15(7), pp.733-740.
2. Wong, C., Avdeev, M. and Ling, C. (2016). Journal of Solid State Chemistry, 243, pp.18-22.

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Primary author(s) : Mr BROWN, Alex (University of Sydney)

Presenter(s) : Mr BROWN, Alex (University of Sydney)

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