Experimental report

05/10/2018

Proposal: 5-32-854 **Council:** 4/2017

Title: Short-range magnetic correlations in the spin-orbit insulator Y2Os2O7

Research area: Physics

This proposal is a new proposal

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Samples: Y2Os2O7

Instrument	Requested days	Allocated days	From	To
D7	4	5	15/03/2018	20/03/2018

Abstract:

We propose to use polarized neutron powder diffraction (XYZ polarization analysis) to measure diffuse magnetic scattering from Y2Os2O7. This cubic pyrochlore insulator does not order magnetically above 2K, but we have evidence from muSR that short-range magnetic correlations develop below about 10K. We shall measure the diffuse magnetic scattering at 2K, 10K and 300K in order to observe how the magnetic correlations develop and correlate the results with our muSR data. The Os4+ paramagnetic moment in Y2Os2O7 derives from an admixture of spin and orbital angular momentum, and forms a geometrically-frustrated sublattice. These are two ingredients that could lead to one of several exotic ground states that have been proposed. Our objective is to determine which, if any, of these ground states forms in Y2Os2O7.

Summary of experiment on $Y_2Os_2O_7$

The experiment was carried out on D7 between 15/3 2018 and 20/3 2018. Present were Henrik Jacobsen, Nathaniel Davies and Jian Rui Soh. The instrument responsible was Lucille Mangin-Thro. The proposal number was 5-32-854.

The sample was a powder of $Y_2Os_2O_7$. We used the 6 point method to extract the magnetic signal and measured at 100 K and at 2 K. The nuclear cross-section shows all the expected Bragg peaks. However, even after several days of conting at the same temperature the magnetic cross section did not show any signal above the background. This indicates that the Os sites do not show long range order down to 2 K, as magnetic Bragg peaks would be observable. The small signal is due to the the small average moment on the Os sites.

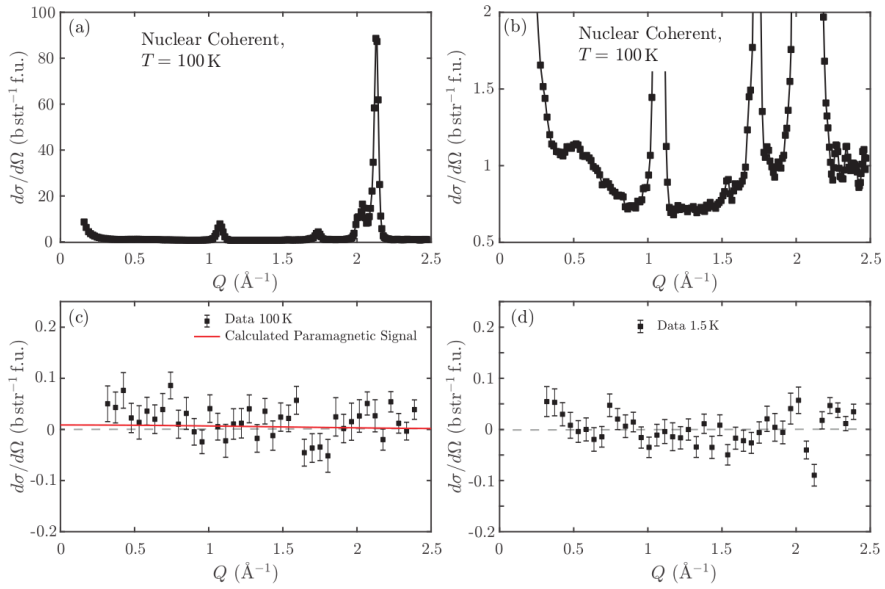

Figure 1: Polarised neutron scattering spectra of $Y_2Os_2O_7$ obtained using the XYZ method. (a) Nuclear coherent cross-section at 100 K. The line is a guide to the eye. (b) Same as (a) but on a different scale to show the diffuse scattering between the Bragg peaks. (c) Magnetic cross-section at 100 K plotted with the calculated paramagnetic signal under the constraints of the magnetic moment obtained from DC magnetisation measurements (d) Magnetic cross-section at 1.5 K.