Experimental report

04/04/2016

Proposal: 5-31-2298 **Council:** 4/2014

Title: Magnetic correlations in Tb2+xTi2-xO7

Research area: Physics

This proposal is a new proposal

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Samples: Tb2Ti2O7

Instrument	Requested days	Allocated days	From	To
D1B	2	2	05/11/2014	07/11/2014

Abstract:

We propose to study the mesoscopic magnetic structure with K= ½ ½ ½ propagation vector in Tb2+xTi2-xO7 pyrochlore for a slight off- stoichiometry (x=-0.01) pyrochlore. According to a recent report, this exotic order (in principle forbidden by fcc translations) is tuned by minute changes of the Tb content. It appears below 0.4K and coexists with the liquid fluctuations down to T=0, where it involves a low ordered moment. Our previous results in 2013 (CRG exp.) intended to measure 3 samples (X=0, 0.01, -0.01) but the last sample was not measured due to a failure of the electronics. The full study will allow to check the evolution of the anomalous correlations throughout the phase diagram.

Experimental reports on Exp. 5-31-2298 at D1B

The results of this experiment on IN4 have been published in Phys Rev B (92 144412 2015)

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Mesoscopic correlations in $Tb_2Ti_2O_7$ spin liquid

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We have studied the spin correlations with $\mathbf{k} = (\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ propagation vector, which appear below 0.4 K in $Tb_2Ti_2O_7$ spin liquid by combining powder neutron diffraction and specific heat on $Tb_{2+x}Ti_{2-x}O_{7+y}$ samples with $x = 0$, 0.01, and -0.01. The $\mathbf{k} = (\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ order clearly appears on all neutron patterns by subtracting a pattern at 1.2(1) K. Refining the subtracted patterns at 0.07 K yields two possible spin structures, with spin-ice-like and monopolelike correlations. Mesoscopic correlations involve Tb moments of 1 to 2 μ_B ordered on a length scale of about 20 Å. In addition, long-range order involving a small spin component of 0.1 to 0.2 μ_B is detected for the $x = 0$ and 0.01 samples showing a peak in the specific heat. Comparison with previous single-crystal data suggests that the $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ order settles in through nanometric spin textures with dominant spin-ice character and correlated orientations, analogous to nanomagnetic twins.

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