Experimental Report

13/02/2015

Proposal:	**4-03-1704**	**Council:**	4/2014	
Title:	Exploring microeV dynamics in Gadolinium Gallium Garnet			
This proposal is a new proposal				
Researh Area:	Physics			
Main proposer:	**DEEN Pascale Petronella**			
Experimental Team:	DEEN Pascale Petronella			
Local Contact:	SEYDEL Tilo FRICK Bernhard			
Samples:	Gd3Ga5O12			

Instrument	Req. Days	All. Days	From	To
IN16B	7	6	04/11/2014	10/11/2014

Abstract:

Gd3Ga5O12 (GGG) is the archetypal frustrated magnet with a
hyperkagome structure of interconnected triangles of Gd3+ ions. Frustration prevents
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Using neutron powder diffraction, Petrenko et al. have shown that short range magnetic order gradually builds up in GGG as the temperature is decreased below ~3 K. The short range magnetic order is expected to organize itself in weakly interacting antiferromagnetic loops that remain dynamic down to the lowest temperatures. These dynamics have been measured with Mössbauer spectroscopy and with muons, showing that the dynamics persists down to the lowest temperatures.

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Experimental report: 4-03-1704: Exploring microeV dynamics in Gd3Ga5O123.

P. Deen. H. Jacobsen. T. Seydel.

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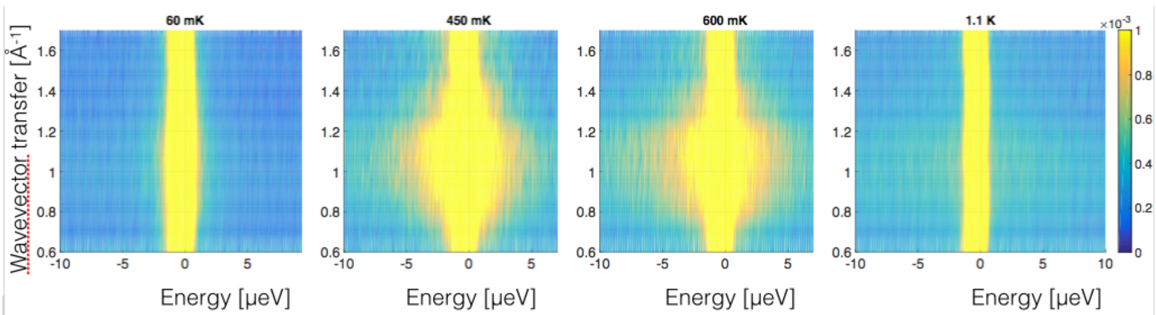

Figure 1: Low lying energy S(Q, ω) of GGG for 60mK < T < 1.1 K

A 2.5 g powdered sample of Gd3Ga5O12 held in a cylindrical Cu sample holder was measured on IN16B with λi = 6.2 Å. A few problems were encountered with the Doppler drive that would periodically fail but only a few hours were lost due to this failure. The sample was cooled in a dilution fridge and spectra were collected at 0.06, 0.175, 0.450, 0.6 and 1.1 K. Fig. 1 shows S(Q, ω) spectra at a range of temperatures and reveals the most unusual aspect of the dynamics in this compound. Namely that elastic scattering dominates the signal at 60 mK, these broaden as the dynamics become faster with increasing temperature before they return to a static state. At 1.1 K the dominant dynamics are found in the Q-resolution of the instrument.

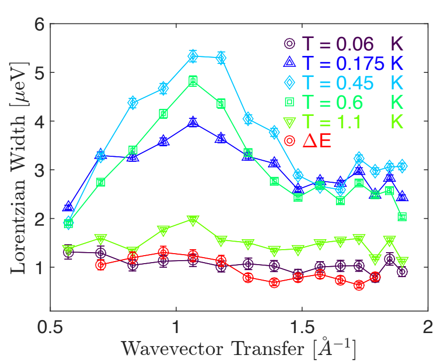

Figure 2: Q and temperature dependence of the Lorenztian Width of the scattering from GGG.

Figure 2 shows the Q dependence and temperature dependence of the Lorenztian width of the scattering profiles (full width at half maximum). The widths were determined using Lorentzian fitting functions with the elastic linewidths fixed by a Vanadium standard. More analysis is required.