Experimental report

14/01/2016

Proposal: 4-03-1713 **Council:** 10/2014

Title: Inelastic neutron scattering studyof spin dynamics in cobalt chromitenanoparticles

Research area: Physics

This proposal is a resubmission of 4-02-434

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Experimental team: Zhendong FU

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Samples: CoCr2O4
Fe8Dy8C122H303N21O96

Instrument	Requested days	Allocated days	From	To
IN6	4	4	19/06/2015	23/06/2015
IN5	4	0		

Abstract:

Nanoparticles within size range of 1-20 nm are known to exhibit interesting physical and chemical properties that can significantly differ from those of bulk materials due to the size effect. The most prominent is superparamagnetism (SPM), which is a thermally driven magnetization reversal. CoCr2O4 nanoparticles have been synthesized and show a transition from paramagnetic to SPM phase in contrast with the transition from paramagnetic to long-range ferrimagnetic phase reported in bulk. We propose to carry out a thorough investigation of the magnetic dynamics of CoCr2O4 nanoparticles on IN5 or IN6 at ILL. Our aim is to extract the superparamagnetic fluctuations and collective magnetic excitations simultaneously at various temperatures and external fields.

Experimental report: Inelastic neutron scattering study of spin dynamics in cobalt chromite nanoparticles

We have measured the inelastic neutron scattering spectra from both bulk and nanopowder of cobalt chromite ($CoCr_2O_4$) on IN6 at various temperatures. The INS spectra for bulk sample and nanopowders are shown in Fig. 1 and Fig. 2, respectively. The spectra of nanopowders show more quasielastic signal than those of bulk because of the disordered surface spins and vibrations of individual nanoparticles. The quasielastic and inelastic scattering components of both samples will be fitted to fully understand the dynamics of $CoCr_2O_4$ nanoparticles.

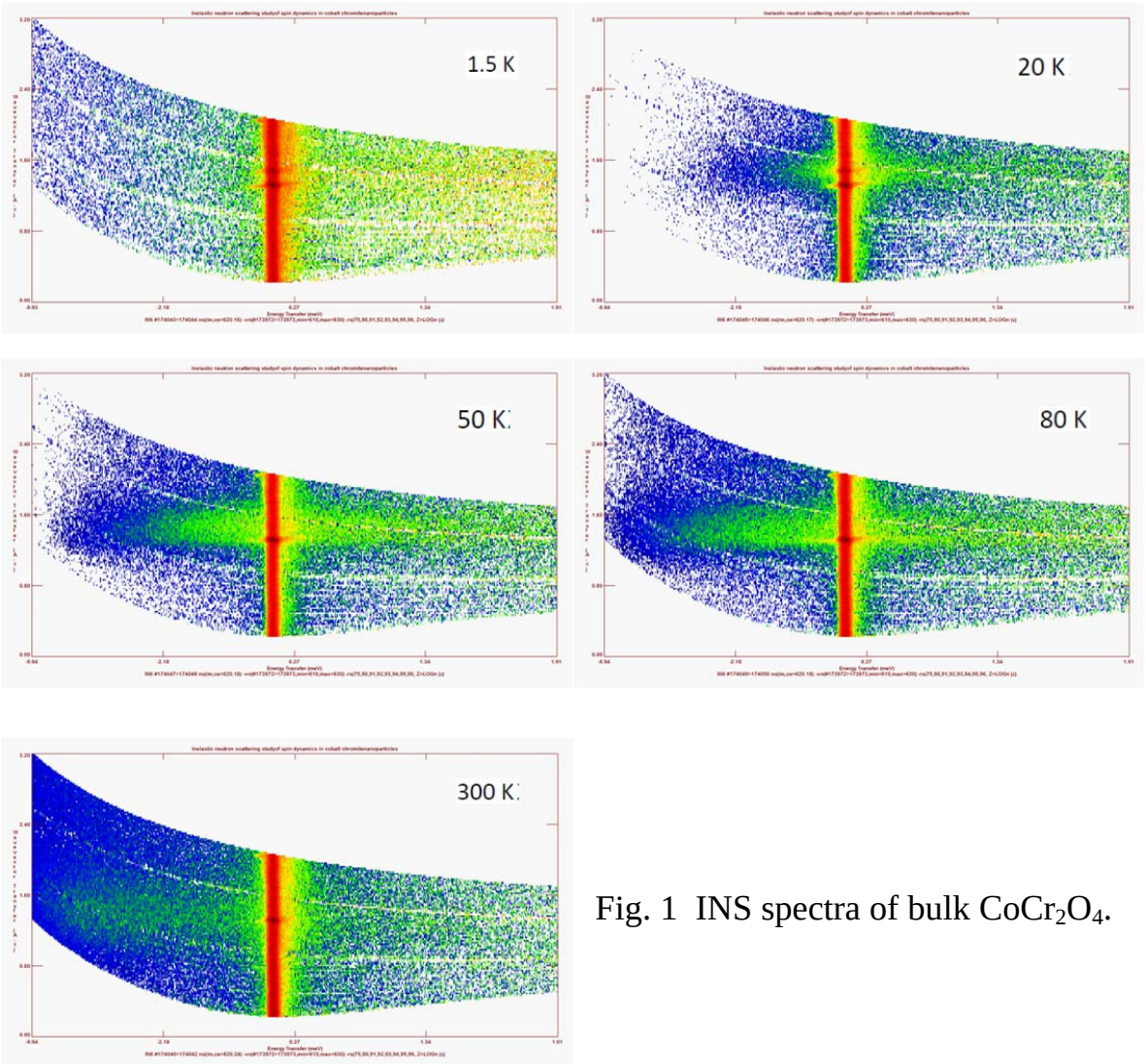

Fig. 1 INS spectra of bulk $CoCr_2O_4$.

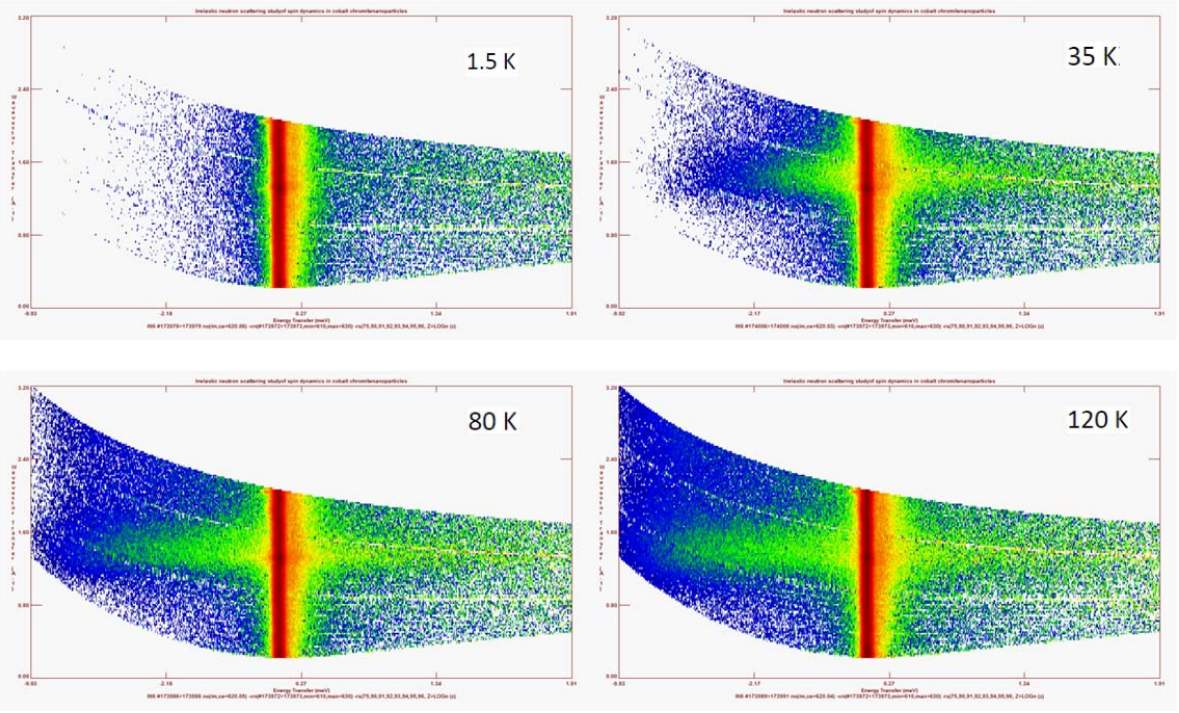

Fig. 2 INS spectra of $CoCr_2O_4$ nanoparticles.