Experimental report

05/02/2016

Proposal: 4-01-1417 **Council:** 10/2014

Title: Magnetic excitation spectrum of highly hole doped layered nickelates

Research area: Physics

This proposal is a new proposal

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Samples: La1.2Sr0.8NiO4

Instrument	Requested days	Allocated days	From	To
IN3	0	7	07/05/2015	13/05/2015
			15/09/2015	16/09/2015
IN8	5	6	14/09/2015	18/09/2015

Abstract:

Although charge stripes have been initially discovered in La2-xSrxNiO4 systems and although these findings have triggered a tremendous research activity (documented by the high number of citations), very few is known about the *highly* hole doped La2-xSrxNiO4 materials. Due to the extreme difficulties of sample growth most studies at high hole-doping are only based on polycrystalline powders. Using novel high pressure floating zone furnaces we were able to grow highly hole-doped La2-xSrxNiO4 materials as sizeable single crystals. To study the nature of the magnetic excitations in these highly-hole doped nickelates appears quite interesting since the role of Ni2+ ions and Ni3+ ions is exchanged regarding the magnetic stripe phases occuring in these systems, and, opposite to the case of lower hole doped nickelates around 1/3 doping. Our observation of only transverse magnetic sattelite reflections with unexpected incommensurability values in La1.2Sr0.8NiO4 was quite surprising. Moreover, the low energy magnetic excitations of La1.2Sr0.8NiO4 exhibit a quite steep dispersion. Hence, we propose to measure the entire magnetic excitation spectrum of La1.2Sr0.8NiO4 at the IN8 spectrometer.

Magnetic excitation spectrum of highly hole doped layered nickelates

Although charge stripes have been initially discovered in La2-xSrxNiO4 systems and although these findings have triggered a tremendous research activity, very few is known about the highly hole doped $La_{2-x}Sr_xNiO_4$ materials. Due to the extreme difficulties of sample growth most studies at high hole-doping are only based on polycrystalline powders. Using novel high pressure floating zone furnaces we were able to grow highly hole-doped $R_{2-x}Sr_xNiO_4$ materials as sizeable single crystals (R=rare earth).

We here measured the magnetic excitations in highly hole doped NdSrNiO4. The elastic and low energy magnetic excitations were measured using a PG monochromator. Also a high energy phonon dispersion (not shown) was measured using the Cu (200) monochromator with k_f fixed to 2.662 $Å^{-1}$. Two PG filters were used for suppressin of higher order contamination. **Fig. 1** shows the elastic neutron scattering measured along the (H 1-H 0) direction. The Q dependence of these peaks confirms their magnetic origin. Surpringly, the inelastic signal is very weak and hard to obsere in our measurements. The signal shown in Fig. 2 is dominated by the crystal field excitations of the Nd^{3+} ions at about ~20 and ~40 meV which show no Q dependence.

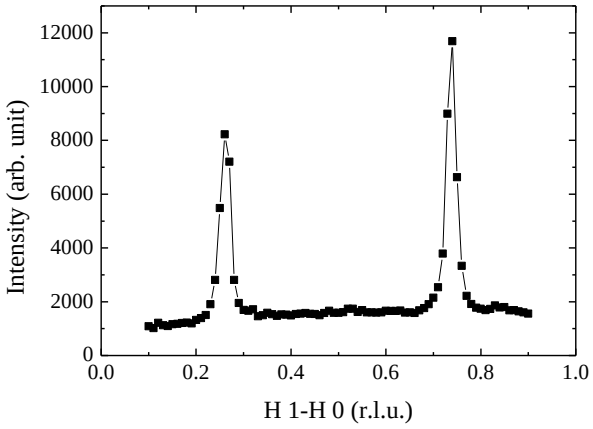

Fig. 1 Elastic neutron scattering intensity along the (H 1-H 0) direction measured at 2 K.

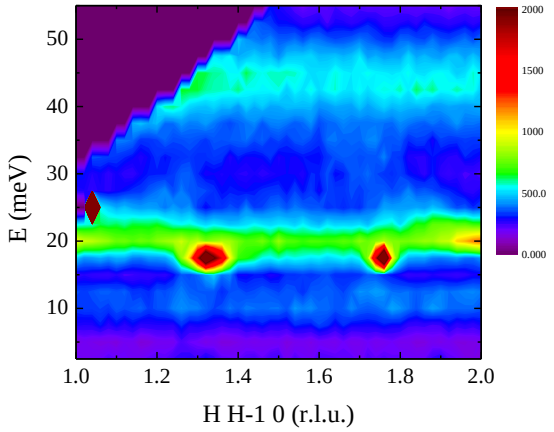

Fig. 2 Q-E map along the (H H-1 0) direction at 2 K.