ESRF

	Experiment title: Electron phonon interaction in stripe- nickelates	Experiment number: HC1121
Beamline:	**Date of experiment**: from: 01/10/2014 to: 08/10/2014	**Date of report**:
Shifts:	**Local contact(s)**: T. Forrest	*Received at ESRF:*

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Report:

We have recently established the ubiquity of charge-density-wave (ICDW) in underdoped superconducting cuprates using various x-ray scattering techniques. A high resolution high resolution inelastic x-ray scattering experiment on $YBCO_{6.6}$ revealed a quasi-elastic 'central peak' accompanied with strong phonon anomalies, associated respectively to the formation of CDW nanodomains and to strongly anisotropic electron-phonon interaction. These results have been published as an article in Nature Physics (Le Tacon et al. Nature Physics 10 52-56 (2014)).

The main purpose of the experiment HC-1700 was to explore whether similar phenomenon were present in strongly correlated $La_{2-x}Sr_xNiO_4$, an insulator known for being a prototypical material for the study of stripe ordering. CDW and stripe order (charge+spin order) have respectively been observed in different families of superconducting cuprates, and are believed, according to certain class of theories, to have the same physical origin, namely the strong coulomb repulsion between holes in doped Mott insulators.

We have focused our investigation on $La_{1.67}Sr_{0.33}NiO_4$, where diagonal stripes commensurate with the underlying lattice have been identified and widely studied using neutron scattering. The charge-stripe ordering sets in a T_N= 240 K. Favorable Brillouin zones for the investigation of phonons had previously been identified using diffuse scattering (115 and 223) and fine inelastic scans where performed in the hh0 (or -h-h0) direction, across the stripe ordering wave vector (0.333 0.333 0), slightly above and below the ordering transition (T = 245, 240, 260 and 235 K where investigated).

A large increase of the elastic line is seen as we cool down to the striped ordered phase (Fig. 1b below). This is associated with the formation of growing domains above the phase transition. Below the ordering temperature, it turns into a Bragg reflection associated with the translational symmetry breaking.
We have carefully investigated the temperature dependence of the low energy acoustical and optical phonon near the stripe ordering wave vector, but no anomaly (in the energy or in the linewidth of the phonons) have been observed, in quantitative contrast with the case of charge order in the cuprates.

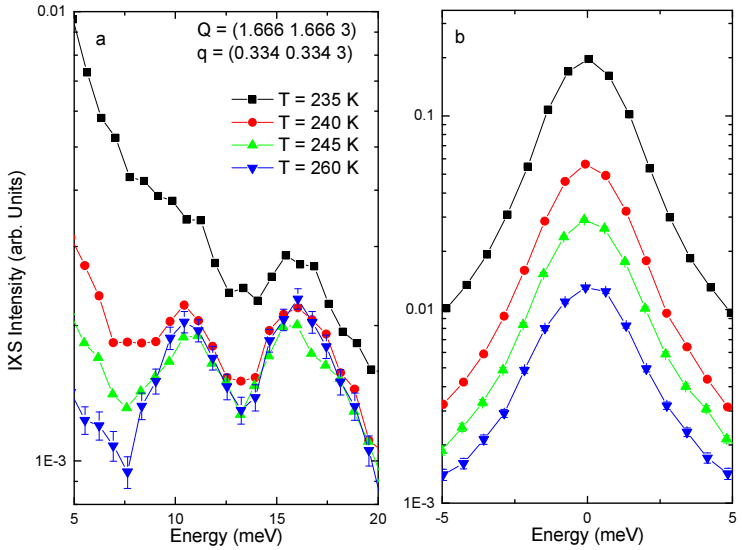

Fig. 1 Temperature dependence of the IXS spectra near $Q_{stripes}$

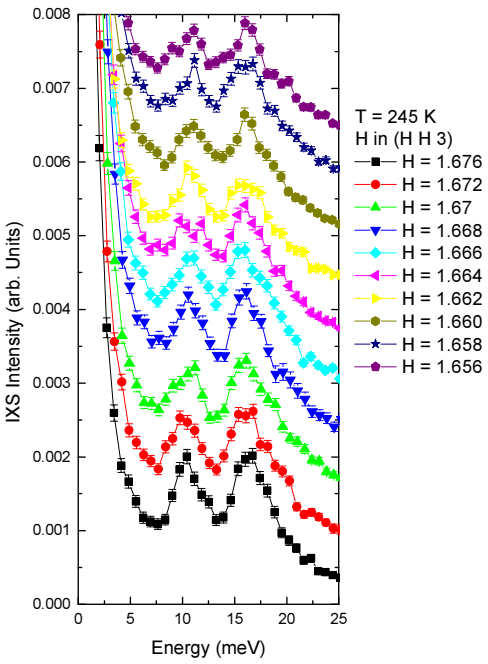

Fig. 2 Dispersion of the low energy phonon across $Q_{stripes}$, just above the ordering temperature.