ESRF	**Experiment title:** "Search for phonon anomalies in the Antiferro-Paramagnetic phase of CeSb"	**Experiment number**: HC-2194
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Report:

The experiment was carried out on a high-quality single crystal of CeSb using ID28 with an incident energy E=17.794 keV, corresponding to the Si(999) + multilayer setups in reflection geometry. The sample of dimension of 2x2x3 mm^3 was oriented with the specular direction along the (100) crystal axis and glued in a custom support between two permanent magnets of NdFeB with the magnetic field H~0.8T aligned in the (100) crystallographic axis.

During the first part of the experiment we have completed the dispersion curves at room temperature, and the results are plotted in Fig.1. The phonon dispersions agree with those of NdSb determined in Ref.[1] and plotted in the same figure. Quite surprising the longitudinal optic phonon in the [111] direction present a "wing like" anomaly and doesn't fit to previous phonon calculation.

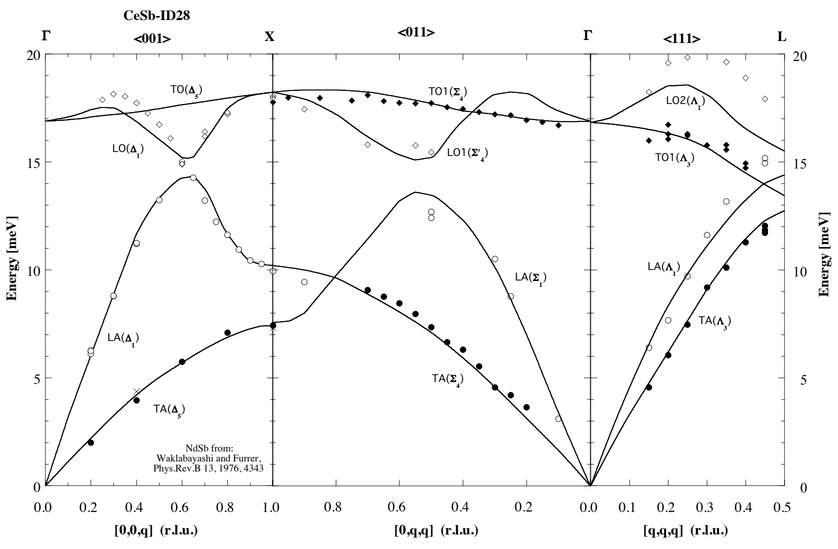

Fig.1 : Completed dispersion curves of CeSb determined at ID28.

Current effort are made to model the vibrational spectrum.

The second part of the experiment was done at low temperature, and using a permanent magnetic field of about 0.8 T to orient the magnetic moments of Ce in the ordered phases. At low temperature (below 9K) the system is antiferromagnetic, and with a weak magnetoelastic interaction which As we can see from Fig.2, at 14K extra elastic Bragg peak appears, associated to the modulation τ=2/7 of the lattice planes alond the (100) direction. In this phase called AFP3 are visible also the 2τ and the 3τ Fourier component associated to the "square" displacements of the Ce planes, which follows the existence of the paramagnetic plane of Ce-(Γ_7) and intercalated between the Ce(Γ_8) ferromagnetic planes following the magnetic ordering (++--+o-)* , as shown in Ref.[1]. At higher temperature a mixed phase appears in which a remanent AFP3 phase togeter with the phase FP1 and AFP1.

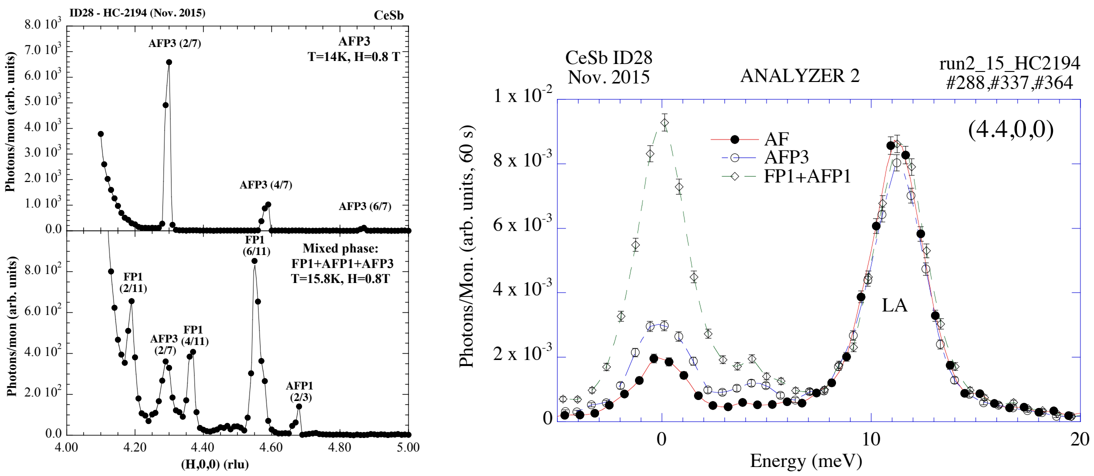

Fig.2 : Left: Elastic scans along the (4+H,0,0) directions at two different temperatures in which the paramagnetic planes of Ce are formed. In the AFP3 (antiferro-para) phase at T=14K the satellite reflections τ =2/7, 2 τ =4/7 and 3 τ =6/7 are clearly visible, whereas at T=15.8K the dominant FP1 phase (τ=2/11) is mixed with the AFP1 (τ=2/3) and a residual AFP3 (τ=2/7) phases. Right: Inelastic longitudinal energy scans showing the increase of the forbidden mode at E=4.3 meV when the paramagnetic planes are formed. Notice also the absence of this forbidden mode at low temperature in the pure antiferromagnetic (AF) phase.

In the presence of the paramagnetic planes, a new inelastic excitation appears in the low energy side of the (4.4,0,0) longitudinal scan, and the intensity increase with the increasing of the paramagnetic planes. We believe that this observation is associate to the longitudinal acoustic phonon mode associated to the presence of the lattice modulation. The energy resolution of 3 meV don't allows a precise determination of the dispersion curve, which must be follows the LA acoustic dispersion associated to the q=(2/7,0,0) bragg peak due to the crystal lattice modulation in the direction of the (100) direction. Further experiments are required to prove the dispersion relation of this new mode, using a high resolution Si(12,12,12) setup.

* +(-) indicate the ferromagnetic Ce$-\Gamma_8$ up (down) state and o for the Ce$-\Gamma_8$ paramagnetic

Ref.[1] J. Rossat-Mignot et al., J.M.M.M. 52, (1985) 111-121

Ref.[2] D. McMorrow et al., J. Phys. Cond. Matter 9, (1997) 1133