ESRF	**Experiment title:** **Step induced in-plane anisotropy of FexNi1-x ultrathin films.**	**Experiment number**: HE - 545
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Report:

The relationship between the structure of thin magnetic films and their magnetic anisotropy has been investigated in this project. In order to separate the different contributions of the usual structural configurations to the magnetic anisotropy it is mandatory to analyse a sample with a single type of defects. In the present work we focused on the effect of steps (from a vicinal Cu(111) substrate) on the magnetic in-plane anisotropy of ferromagnetic ultrathin Fe_xNi_{1-x} alloy films. It has been shown that related to the epitaxial growth of the alloys the invar effect can be trapped and the ultrathin films are ferromagnetic even for x=0.8 (Fe rich alloys). This is related to the stable fcc structure induced by the substrate.

The aim of our experiment was to study the in-plane magnetic anisotropy induced by a vicinal surface exhibiting atomic steps (Cu(111) single crystal with a miscut of 1.2° along $[11\bar{2}]$) on the ultrathin Fe_xNi_{1-x} films.

First MCXD results were obtained at the $FeL_{2,3}$ edges by our group at LURE synchrotron radiation facilities using the high circular polarisation rate of beam line SU23.

Application of the sum rules, for 7ML $Fe_{70}Ni_{30}$ / Cu(111), leads to an important difference of the ratio $R=M_L/M_S$ between two in-plane directions, parallel and perpendicular to the steps.

The work done at the ESRF at beam line ID12 B confirms the previous data and extends the thickness range toward thinner films (2-10ML). The magnetic anisotropy induced by the steps is always measurable and persists up to the thickest investigated situation i.e. a 10ML thick alloy. Because of the Curie temperature versus thickness dependence the measurements were done between room temperature and 30 K. In order to magnetise the film in the surface plane, mandatory to obtain the in-plane orbital and spin magnetic moments, the standard set-up was not well suited. Two modifications were successfully implemented by the ID12B team: (i) a permanent in-plane magnetisation and (ii) the sample was mounted on a new designed sample holder in order to explore different azimuth angles of the in-plane orbital and spin magnetic moments. For each of the in-situ evaporated ultrathin Fe_xNi_{1-x} films the magnetisation direction could thus be continuously tuned between parallel and perpendicular to the steps. On the normalised (at the Fe L_3 edge) difference spectra (fig.1), obtained by phase swiping, the expected effect is obtained. One can notice the different L_3 / L_2 ratio between the parallel and the 35° azimuth geometry. On the other hand the low signal to noise ratio prevent for the extraction of reliable values of the magnetic moments.

For further experiments, more quantitative results can easily be expected by improving the sample to mass isolation and the beam quality (2/3 filling would improve the noise and allow investigating thinner films).

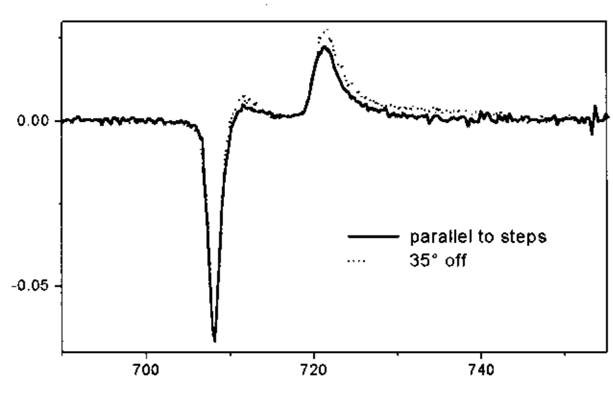

Fig.1: Two Normalised Fe $L_{2,3}$ XMCD difference spectra recorded along two different in-plane magnetisation directions at room temperature for 10 ML $Fe_{70}Ni_{30}$/Cu(111).