ESRF	**Experiment title:** First XMCD experiments on a magnetic coupled interface:Co on NiO(111)	**Experiment number:** HE 344
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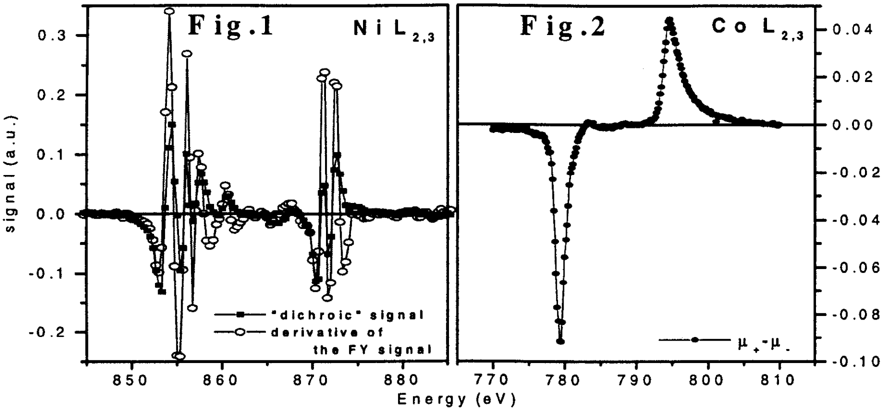
Preliminary report:

The aim of this test experiment was to measure for the first time the magnetic moments of the Co and Ni atoms (the last one only if exists) at the Co/NiO(111) interface.

A 18Å Ag capping layer was used to protect the Co film. It was found that the Ag layer was not continuous, which lead to a partial oxidation of the film between its preparation and the XMCD measurements (performed about 3 months later). The Co0 surface layer, which is insulating, made impossible the biasing of the sample, since NiO(111) single crystals are highly insulating ; so attempts to use electron yield (EY) detection failed. Fluorescence yield (FY) signal was successfully recorded for theses samples.

Unfortunately, <u>all</u> our FY data were affected by a technical problem: during the « flip scans » (see the end note), a small derivative in energy occurred, which shifted the energy when the FY signal for the 2nd orientation of the magnetic field was measured, with respect to the 1^{st}. In consequence, two points supposed to be measured at the same energy with opposite magnetic field orientation are in fact at different energies, the shift (~10- 100 meV) being lower than the energy step (~350meV) used for the scans. Scans were performed at Co $L_{2,3}$ and Ni $L_{2,3}$ edges in different geometries. The instability in energy is well evidenced by the signal obtained for Ni. For an antiferromagnetic material, no dichroic signal should be expected. Fig.1 shows the difference between two spectra taken on pure NiO (in order to check a clean surface, with no coupling layer, and to get a clear identification of the problem). It is clearly shown that the signal originates from this derivative in energy (which is equivalent to the derivative of the measured FY spectra).



Despite this, the Co FY was successfully measured, but as it will be seen later, the dichroic signal could not be worked out properly. The zero-thickness limit was used for the 20Å Co layer (I_{FY}~μ), while for the 200Å film the dependence is no more linear: in this last case, 2 measurements at different angles were performed in order to deduce μ.

The analysis of these data lead to small values for the total magnetic moment of Co : 0.469-0.748μ_B (see Fig.2). Even if a 0.01-0.1eV shift at Ni edge is attempted, the resulting dichroic spectra give no major change on the magnetic moment. The energy derivative cannot however be expected to be linear, or the same, at the Co edge. Moreover, playing with the data in this way cannot be justified.

The derivative in energy makes these measurements unreliable, so we cannot definitively be sure that there is a decrease of the magnetic moment of the Co at the interface. Moreover, if a Ni signal exists at the interface, it is hidden by the energy shift; in order to answer these questions, very precise measurements are needed.

The beamline staff say that the problem of the derivative was a problem in the data aquisition sequence when using the flip scan. This problem has subsequently been solved, as very high quality data has been achieved (e.g. Goedkoop et al.)

New measurements are mandatory to fulfil1 the proposed experiment.

Note : « flip scan » : after the monochromator reaches the remote energy, the FY signal is measured with one orientation of the magnetic field, then the field is reversed, then FY signal re-measured. If delay time before measuring is less then the time need to stabilize field and energy (- lsec.), this could lead to an energy shift which affect all data.