ESRF	**Experiment title:** XMCD study of a new ferromagnetic compound $CaCo_2$	**Experiment number**: HE-2722
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Names and affiliations of applicants (* indicates experimentalists):

Fabrice Wilhelm*, *ESRF*

Alevtina Smekhova*, *ESRF*

Andrei Rogalev*, *ESRF*

José Goulon*, *ESRF*

Report:

In this experiment, we have investigated the magnetism on both the Co and Ca sites by means of the X-ray magnetic circular dichroism (XMCD) technique. The $CaCo_2$ compound was synthesized from the initial mixture of components in a high-pressure chamber of the Toroid type at a 8.0GPa pressure and under heating to the melting point. Heating was effected by current passage through the sample placed within a tube made of a potassium chloride single crystal. Importantly, this metastable high-pressure phase remains intact under normal conditions for a long time (the stablest of them, $CaCo_2$, can be kept for several months). $CaCo_2$ is a ferromagnet with a Curie temperature of 528K. The macroscopic magnetic moment at T=4.2K in a 0.9Tesla external magnetic field is 3.4 μB/f.u. XMCD experiments were performed on different polycrystalline samples (that have been prepared on different time) to ensure that the observed XAS and XMCD signals are not contaminated from aging effects . In figure 1, we show the Co K-edge X-ray absorption spectra and the corresponding XMCD spectra recorded at 290K and under 6Tesla.

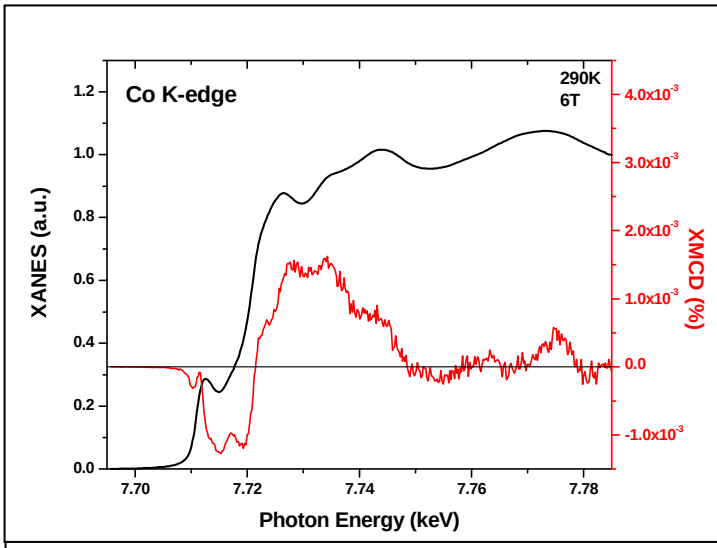

Fig.1: XAS (left scale and black line) and XMCD (right scale and red line) recorded at the Co K-edge.

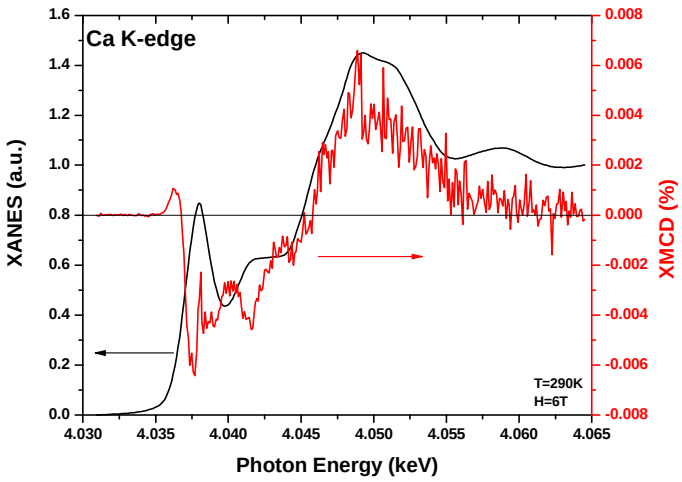

Fig.2: XAS (left scale and black line) and XMCD (right scale and red line) recorded at the Ca K-edge. The data are corrected from self-absorption effects and from the incoming circular polarization rate (~56%).

In figure 2, we show the XAS and XMCD spectra recorded at the Ca K-edge under the same experimental condition. The Ca K-edge presents a strong pre-edge feature were the maximum XMCD signal is located. A similar pre-edge feature is also seen in the Co K-edge.The XMCD signal intensity is as small as 6.10^{-3} with respect of the edge jump of unity. We can observe a strong similarity between the XMCD signal of Ca and Co that have the same signal sign but three times larger in amplitude. The XMCD signal measured at the Ca K-edge will clearly demonstrate that 4p states of Ca are polarized *via* hybridization with 4p-3d shell of the Co transition metals. Indeed, due to the 4*p*(Co)-4*p*(Ca) hybridization, an induced polarization at the Ca K-edge was suspected and now observed.

Fully relativistic LMTO calculations revealed a moment per Co atom in $CaCo_2$ close to a moment of pure Co that is quantitative good agreement with the results obtained by SQUID. Moreover, a ferrimagnetic ordering of the sublattices with a small total induced negative moment on Ca up to ~ -0.20μB was obtained. Further calculations are under way to understand the presence of splittings in the XMCD signal at the Co and Ca K-edge and to simulate the XMCD signal to reveal the possible presence of quadrupolar transitions.