ESRF	**Experiment title:** Cobalt magnetism under high pressure: magnetic structure in the hcp-fcc transition	**Experiment number**: HE-3199
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Preliminary Report:

Abstract:
The magnetism and structure of compressed cobalt has been studied up to 120 GPa using Co K-edge X-ray Magnetic Circular Dichroism (XMCD) and X-ray Absorption Near Edge Spectroscopy (XANES). We observe a local fcc-like distortion starting above 80 GPa and the total suppression of the XMCD signal below 120GPa, where XANES analysis indicates an hcp:fcc phase fraction of the order of 70:30. The results have enabled us to consider the interrelationship between structure and collapse of ferromagnetism in cobalt, providing experimental confirmation to the theoretical predictions of the loss of magnetism in Co at the onset of the hcp-fcc phase transition.

Figure 1 shows the combined XAS and XMCD data recorded on ID24. The absorption energy range is limited to the XANES area and first oscillation of EXAFS (extended x-ray absorption fine structure). Three features (labelled A, B-B', and C) can be identified. Upon compression, we observe a continuous increase in the intensity of feature A at E=4 eV from the edge (energy of the "dipole forbidden" 1s-3d quadrupole transition). This phenomenon has been ascribed to the increase in the p-character of the d-bands (which adds "dipole allowed" intensity to this transition). Pressure indeed favours 3d-4p overlap (hybridization), as the 3d bands widen and the 3d electrons become more delocalized. The double peak feature B B'(17 and 25 eV from the edge) changes its shape under compression and the relative height of B and B' is inverted above 80 GPa. Finally the intense peak (C), at E= 49 eV after the edge, becomes sharper and more pronounced with pressure, while shifting to higher energies as a consequence of compression. These modifications in the XANES shape may be precursor signs of the hcp-fcc structural phase transition. In order to shed light on these aspects we are undertaking XANES simulations using the FEFF8

package. The right panel of Figure 1 presents the XMCD spectra obtained on ID24, normalized to the absorption edge step. The XMCD signal decreases with increasing pressure until the complete suppression at 120±15 GPa signalling the disapearance of ferromagnetic order in Co at this pressure.

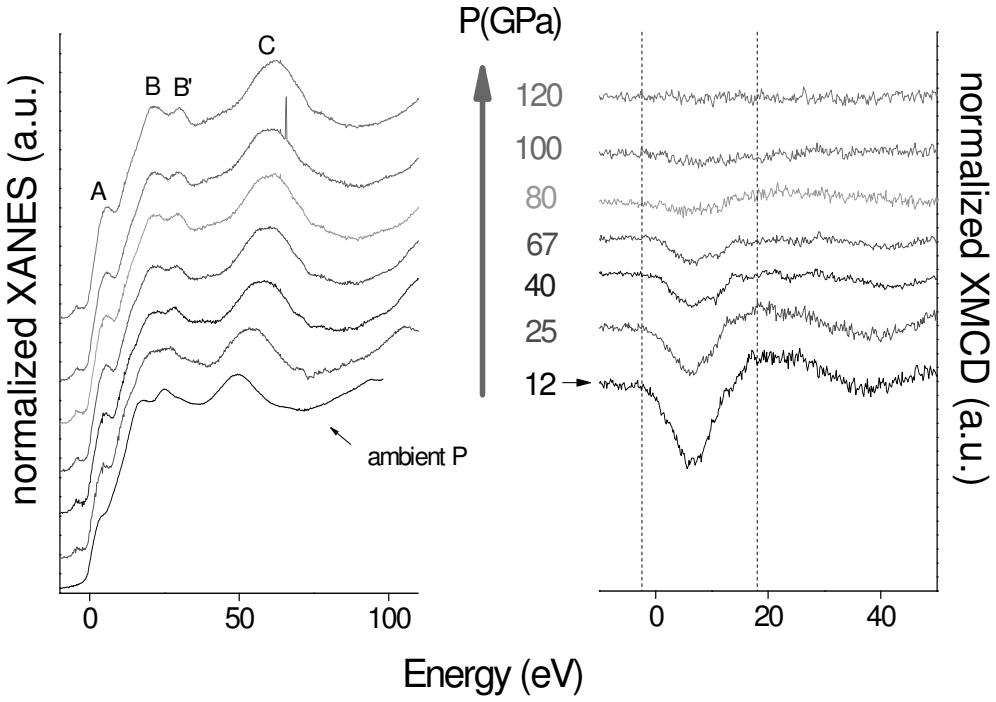

Fig. 1 : Normalized K-edge XANES (left) and XMCD (right) spectra of cobalt as a function of pressure (ID24).

By combining XANES and XMCD measurements we have been able to experimentally investigate the interplay between local structure and magnetism in cobalt at high pressure. Further analysis of the results is ongoing.