ESRF	Experiment title: **High pressure XMCD study of the Pt-*5d* magnetic states in the (CrMn)Pt_3 system.**	**Experiment number**: HE-725
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Report:

High pressure studies of magnetism

Element selective XMCD carried out under pressure is a direct way to evaluate the induced magnetism of 5d elements hybridized with a magnetic 3d element in 5d/3d alloys. The strength of the spin hybridization is controlled by the inter-atomic distance.

The Pt_3Cr system has been chosen as model system. In fact, recent work[1,2] reports on the magnetism of Pt in this alloy which is very unusual; the L_3 and L_2 XMCD signals have the same sign, meaning a dominant orbital contribution. Pt_3Cr is therefore a good candidate to investigate volume-dependent magnetism of Pt. In addition the Curie temperature is 450 K, well above the room temperature. Moreover, only the crystallographically ordered phase carries a magnetic moment. A great pressure sensitivity of the magnetic moment is therefore expected because changes in crystallographic phase or order can be induced.

Both L_3 and L_2 edges XMCD have been measured under pressure, thereby probing the 5d Pt magnetic moment. X-ray diffraction under pressure doesn't show any change in the crystallographic structure of Pt_3Cr, which remains cubic. The XMCD signals under pressure at the Pt L_3 and L_2 edges (shown in the figure) show a slow decrease between 0 and 35 kbar followed by a very abrupt increase between 35 and 50 kb.

The first decrease reflects an attenuation of the magnetic moment carried by the Pt 5d states along the x-ray propagation axis. It could originate from a decrease of the Cr magnetic moment, inducing a smaller Pt magnetic moment, or from a progressive change of the magnetic order resulting in a smaller ferromagnetic component.

The following increase of the platinum 5d band magnetic moment is induced by the increasing hybridization with the 3d Cr band. This second effect is probably already present between 0 and 35 kb but is hidden by the decrease of the total projected moment. After 50 kb there is a rapid attenuation of the signal, which could be due to the loss of the crystallographic order in the sample.

The main result of this study is the constant branching ratio along the pressure domain. There is no L/S ratio variation between 0 and 50 kb which is rather surprising considering the strong magnetic moment dependence from crystallographic order. The disappearance of the magnetic moment with the loss of crystallographic order shows the great sensitivity of the orbital and spin moment to the local order. At the same time, their ratio remains insensitive to the reduction of interatomic distance between 0 and 50 kb (which is typically ~ 0.7%). The loss of crystallographic order after 50 kb must be studied in more detail by x-ray diffraction. It could be sample preparation dependent and to be overcome in the next future. This could allow the measurement of XMCD signals at higher pressures up to the orbital moment quenching.

References
1. W. Grange et al., J.Sychrotron Radiation 1999
2. Maruyama et al., JMMM 1995, **140-144**, 43-44

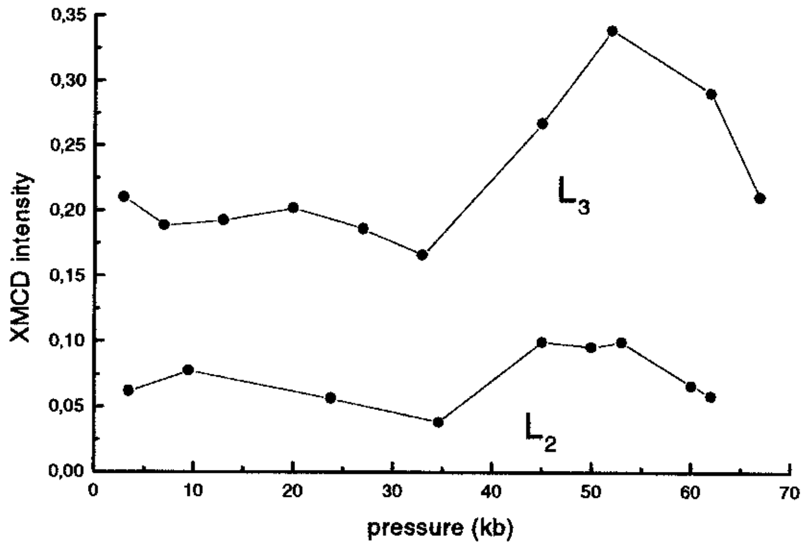

Figure1: Integral of Pt L_3 and L_2 XMCD signals on Pt_3Cr as a function of pressure.