ESRF	**Experiment title:** High resolution and spin resolved X-ray emission spectroscopy of magnetite and maghemite under pressure	**Experiment number:** HE-1841
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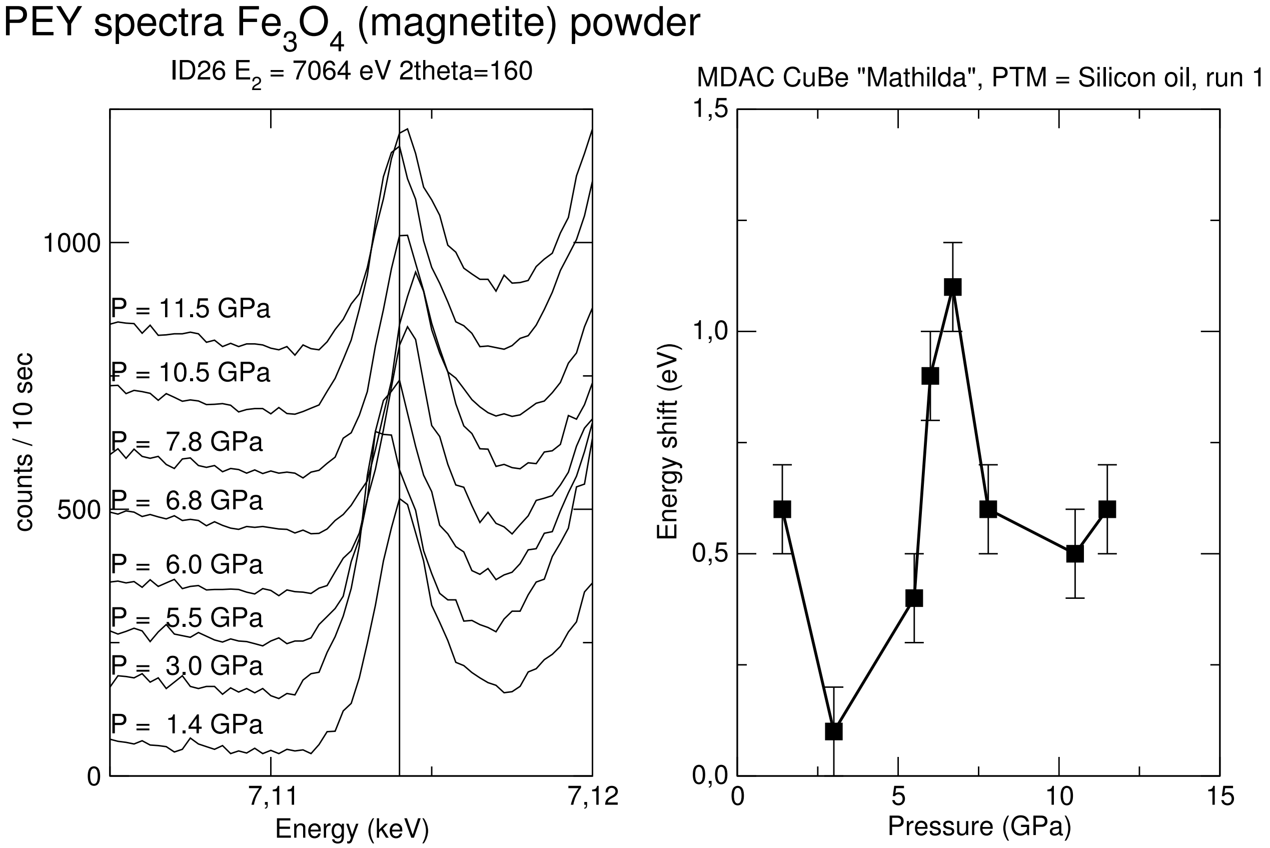
Report:

Previous very puzzling results on XANES and dichroism of Fe_3O_4 [1] have motivated the present work. Fe_3O_4 shows a transition, interpreted as a Metal-Insulator Transition and(or) a Verwey Transition, has been recently reported at 8 GPa by Todo *et al.* [2], in contradiction with previous results by Rozemberg *et al.* [3], who report 16 GPa. We observe an abrupt change of the room temperature dichroic signal at *both* of these pressures: first as an abrupt rise of the signal, and subsequently as a fast decrease. Although we do not have a direct interpretation of this result, this point out that two different events are taking place at these pressures in the electronic structure of Fe_3O_4. It has been recently shown that the K pre-edge feature can be interpreted in Ligand Field Multiplet (LFM) theory [4,5]. However, application of the theory to XMCD are not yet developed, and a full interpretation based on a comparison between experimental data and the calculated spectra require precise information on the isotropic absorption, as can be obtained with high resolution X-ray-emission spectroscopy data (see [6]), using an inelastic x-ray spectrometer. Well resolved features in the absorption spectra will allow to constrain the LFM model calculations, and therefore to disentangle contribution from different valence states and from different symmetry environments for the iron. Moreover, Inelastic X-ray Spectroscopy (IXS), can directly probe the magnetic state of the $3d$ orbitals, as shown *e.g.* in [7], in a way which is complementary to our XMCD approach. This is possible either by measuring the K_β line-shape, or performing spin resolved spectra by choosing different emission energies on the K_β line corresponding to different spin states.

Some preliminary analysis seems to indicate that we observe a similar behaviour for the K pre-edge feature energy (See figure). In fact, this come from a slight shift in the population of the different contribution of the feature. However only a limited set of data is studied, and the result needs to be confirmed by a full data treatment. The problem arise from incertitude on the energy calibration form some scan. Moreover, with the same precaution on the statistic, the K_β line, do not confirm the results.



Left panel *PEY spectra of* Fe_3O_4 *on the K pre-edge energy region at different pressure. Each scan is shifted of 100 counts for better clarity.*
Right panel *K pre-edge energy shift as a function of pressure.*

Conclusion will be drawn soon at the and of the complete treatment of the data.

References

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