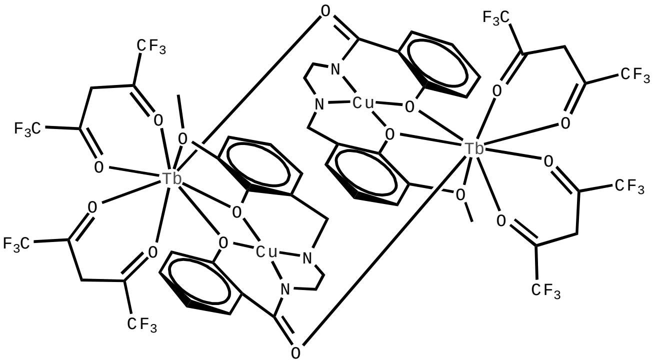
HE1638 summary report

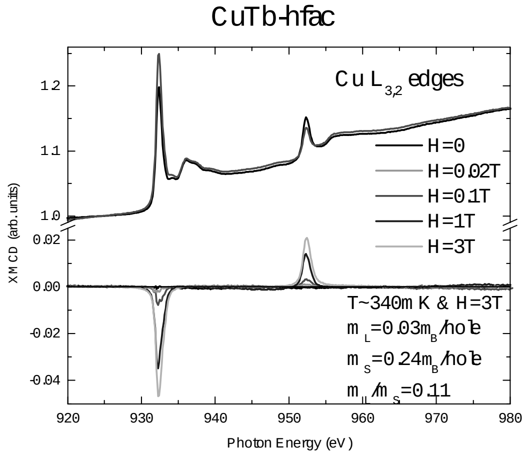
Our main goal was to investigate the magnetic properties of the purported single molecule magnet $[Cu^{(II)}Tb^{(III)}(hfac)_2]_2$ depicted below. Based on ac-susceptibility measurements (down to 2K) this compound has an estimated blocking temperature of 1.2K. As compared to the ubiquitous "Mn_{12}" single molecule magnet, this compound had two major advantages: its much greater thermal stability and the presence of two different metals.

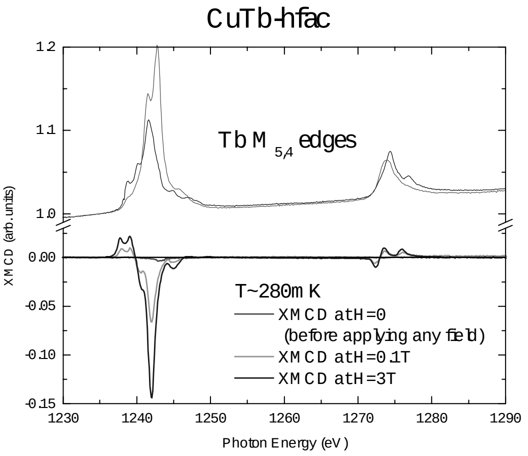


We measured the XMCD at the Cu, Tb, N, O and F edges down to T=0.3K with the purpose of checking several points : do the magnetic properties of Cu and Tb differ, is there a polarization of the O and N ligands, how do things evolve with the temperature? Because of computer problems this last question remains unanswered but we could address the other ones, the main results are summarized below.

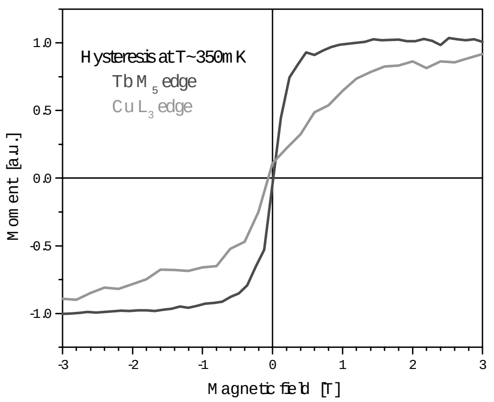
<u>Magnetic properties of Cu and Tb ions</u>.

The XAS and XMCD spectra of the Cu and Tb ions are given in the figures below. The magnetic dichroism is clearly visible, especially at the Tb-M_5 edge.





One of our most interesting findings concerns the shape of the magnetization curves for the two ions, as seen in the figure below.

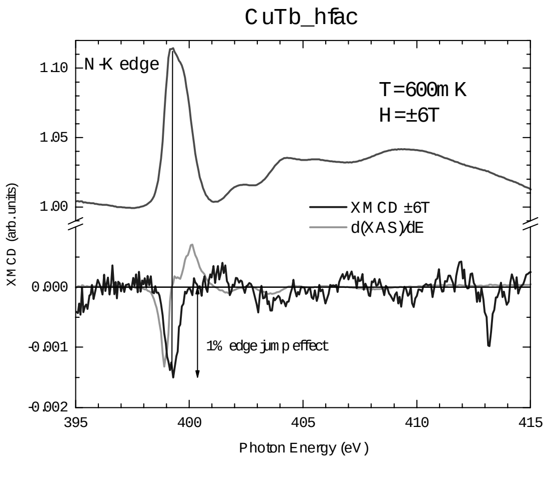


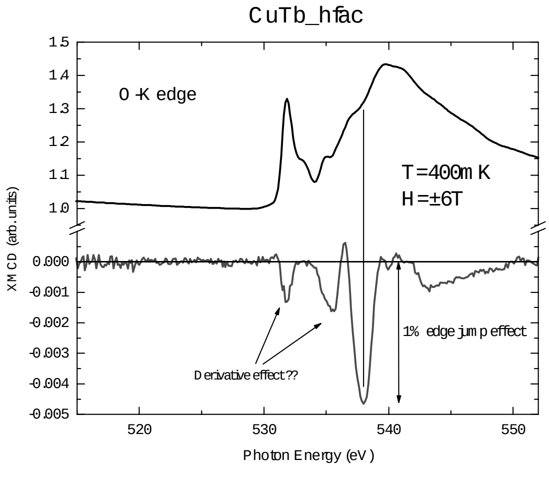
There clearly is a strong behaviour difference between the two ions as the Tb saturates very rapidly whereas the Cu still doesn't at fields up to 3T. Since SQUID measurements prove that the two magnetic centers interact ferromagnetically, XMCD measurements therefore show that the two metals have very different environments, the Cu one being the more anisotropic. That kind of result is exactly what we were looking for as it provides theoreticians with precious insights on the role of ligands and local environment in the setting up of intramolecular ferromagnetism.

We do not see any remnant magnetization but this was to be expected as the sample was an unoriented polycrystalline powder.

Magnetic polarization on N and O atoms.

We have been able to detect a magnetic moment on the light elements N and O, as seen in the figures below (N on the left, O on the right).





The signal at the oxygen K edge is well defined and reproducible, even if two structures can be due to derivatives effects. The signal at the nitrogen K edge is clearer and cannot be ascribed to a derivative effect, as evidenced in the figure.

We hope to make useful comparisons between these and other XMCD spectra recorded on purely organic (only C, H, N, O atoms) ferromagnets. These data haven't been reduced yet.