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Report:

The magnetic EXAFS (MEXAFS) data were recorded using a Tb single crystal. The measurements in the extended energy range of the L_3-edge allowed for a suitable energy range for the EXAFS analysis of ΔE=400 eV. This value corresponds to a maximum possible photoelectron wavenumber of k_{max}=10 Å^{-1}. To keep the degree of circular polarization constant in this extended energy range together with a high photon flux, the gap-scanning technique was used. This reliable technique worked very satisfactorily in our entire beamtime. The data were measured at four temperatures: 10 K, 150 K, 225 K and 250 K. These temperatures were chosen for the following reasons: at 10 K the dynamic disorder due to lattice vibrations and due to spin-fluctuations are reduced to a minimum value. The higher temperatures were selected to be around the Curie temperature of Tb which is T_C=221 K. Hence a slightly higher temperature of 225 K was used to investigate the influence of critical fluctuations close to T_C. A still open question is the degree of magnetic order of the system on a local scale above the Curie temperature. Therefore the highest temperature was set to 250 K. The experimental results for the difference $\Delta\mu(E)$ of the x-ray absorption coefficients for right ($\mu^+(E)$) and left ($\mu^-(E)$) circularly polarized x-rays are given in Fig. 1. Clear MEXAFS wiggles can be detected at 10 K up to a photon energy of 7925 eV. The wiggles fade out starting from the higher photon energies with increasing temperature. This is due to the exponential form of the EXAFS Debye-Waller factor $exp(-2\sigma^2(T)k^2)$ leading to a stronger damping at higher k-values corresponding to higher photon energies. Furthermore, there is a reduction due the decrease of the magnetization M(T) versus temperature. But still at 250 K a clear oscillatory fine structure can be identified. This indicates that there is still magnetic ordering on a local scale in applied

field of 2.7 T. For a more detailed analysis of the local magnetic ordering the individual scattering paths must be investigated in the Fourier transform. But before Fourier transforming the data, contributions due to magnetic multi-electron excitations (MMEs) have to be removed.

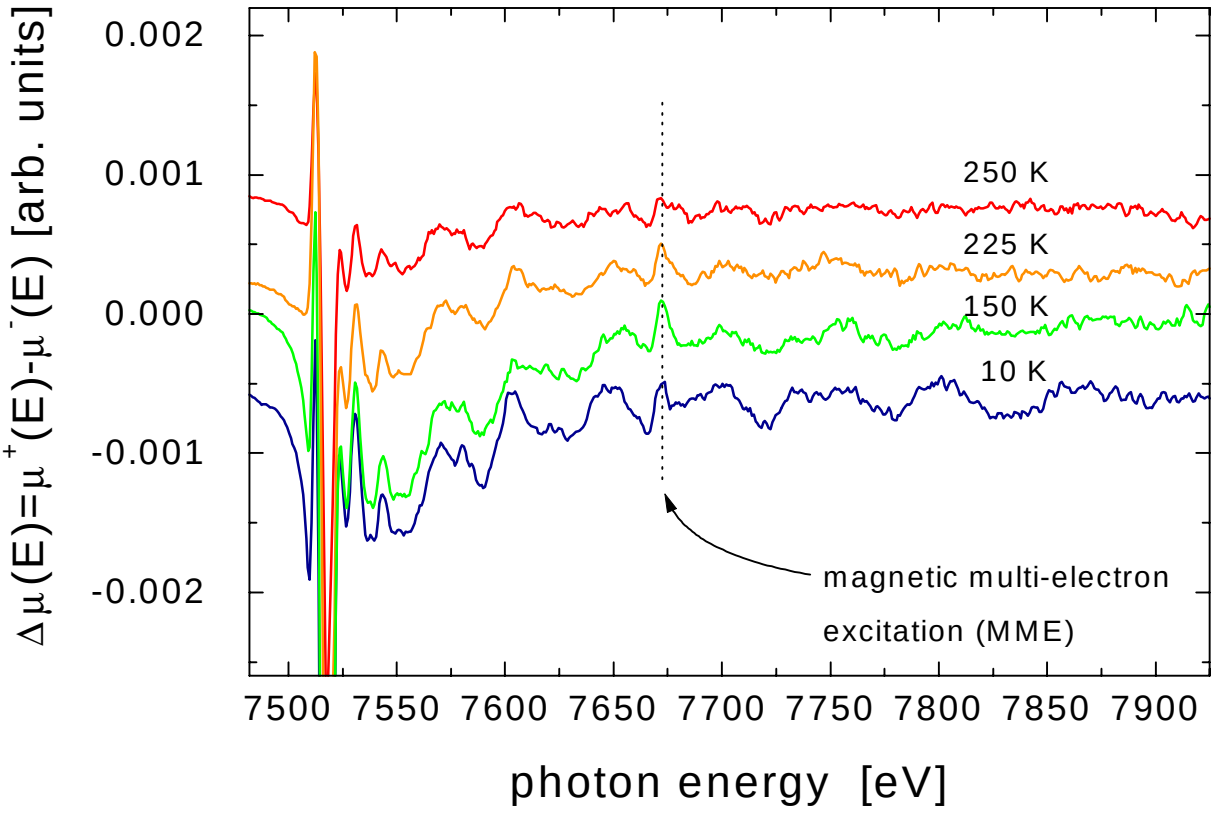

Fig. 1: Difference of the x-ray absorption coefficients for right ($\mu^+(E)$) and left ($\mu^+(E)$) circularly polarized x-rays. Clear MEXAFS wiggles can be detected which get strongly damped at higher photon energies with increasing temperature.

These MMEs are found at a photon energy of about 7670 as marked in Fig. 1. By comparison to *ab initio* calculations using the FEFF code, the origin of the peak-like structure can be identified to be the MME and not the single-electron scattering effect. This code calculates the x-ray absorption coefficients in a single-electron multiple-scattering approach. By means of comparison of the calculation with the experimental data a clear peak-like-structure can be identified. It turned out that the multi-electron excitations have stronger effects on the Fourier transform for the Tb MEXAFS data than it was found in our earlier MEXAFS investigations for Gd [1,2]. We are now working on a reliable subtraction procedure. Then the questions raised above will be analyzed using the Fourier transformed data.

[1] H. Wende, F. Wilhelm, P. Poulopoulos, K. Baberschke, J.W. Freeland, Y.U. Idzerda, A. Rogalev, D.L. Schlagel, T.A. Lograsso and D. Arvanitis, AIP Conference Proceedings vol. **514**, eds. M. Benfatto, C.R. Natoli and E. Pace, Melville (New York), (2000) pp. 140-147.

[2] H. Wende, F. Wilhelm, P. Poulopoulos, A. Rogalev, D.L. Schlagel, T.A. Lograsso and K. Baberschke, J. Synchr. Rad. (in press).