Stuttgarter Physikalisches Kolloquium
Fachbereich Physik, Universität Stuttgart
Max-Planck-Institute für Festkörper- und Metallforschung
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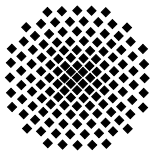

Dienstag, 17. April 2007 | **17.15 Uhr** | **Hörsaal 2 D5**

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EMCD: Magnetic Circular Dichroism in the Electron Microscope

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Abstract

The similarity between XANES (X-ray Absorption Near Edge Structure) and ELNES (electron Energy Loss Near Edge Structure) is well known. Both spectroscopies probe the density of unoccupied electronic states. Whereas photon probes with extraordinary brilliance are now available on synchrotron beam lines allowing fast recording with excellent accuracy, access is sometimes difficult. On the other hand, access to a transmission electron microscope (TEM) is much easier, and ELNES spectroscopy can be combined with many other TEM tools for the investigation of a material with spatial resolution <1nm. X-ray Magnetic Circular Dichroism (XMCD) is routinely studied in synchrotrons. “Exporting” XMCD to the TEM was considered impossible with present technology since an electron probe possessing chirality (i.e. spin polarization) cannot be set up with sufficient intensity. But recently the detection of magnetically induced chiral electronic transitions in the TEM was demonstrated [1].

This makes ELNES in the TEM a strong competitor of the synchrotron for XMCD. In analogy to XMCD we introduced the term EMCD: Energy loss Magnetic *Chiral* Dichroism. In the experiment, a coherent superposition of two momentum transfer vectors wich are perpendicular to each other is set up, and the phase difference between the two inelastic interactions is tuned to $\pi/2$. The inelastic interference term carries the dichroic signature. Experiments on various ferromagnetic materials show a distinctive dichroic signal very similar to XMCD. Calculations based on the WIEN2k package are in good agreement with experiments.

EMCD is new approach to the study of magnetic materials on the nm scale. In combination with other techniques in the TEM it will be useful for actual problems in spintronics.

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