ESRF	**Experiment title:** Resonant Raman scattering excited with circularly polarized x-rays.	**Experiment number:** HC 396
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Report:

Magnetic circular dichroism is observed in x-ray resonant Raman scattering from ***d*** core electrons in magnetically aligned gadolinium at incident photon energies resonant with the $Gd\,2p_{3/2}$ excitations. The dichroism is dominated by the magnetic interactions between the valence $4f$ electrons and the final state ***d*** core hole. Unlike photoabsorption spectroscopy, but similar to core photoelectron spectroscopy, this method allows one to probe electron-correlation effects in the valence ground-state population.

We show that the dominant magnetic character of the multiplet features constituting the emission lines is derived directly from the circular dichroism of these features. Our results, which are quite different for the $3d_{5/2,3/2} \rightarrow 2p_{3/2}\,(L\alpha_{1,2})$ **and the** $4d_{5/2,3/2} \rightarrow 2p_{3/2}\,(L\beta_{2,15})$ emission lines, due to the different relative strengths of exchange and spin-orbit interactions, compare well with similar limit cases measured in XPS and resonant Raman scattering with linear polarized light. When the incident energy is tuned in the vicinity of the $2p_{3/2}$ threshold, the modifications of the circular dichroism spectra can be related to changes in the ground state configuration of the $4f$ and $5d$ orbitals.

Recent atomic multiplet calculations are in good agreement with the experimental results and reproduce the experimental features in great detail.

The experiment resulted so far in two publications:

[l] M.H. Krisch, F. Sette, U. Bergmann, C. Masciovecchio, R Verbeni, J. Goulon, W. Caliebe, and C.C. Kao, Phys. Rev. B 54, R12673 (1996).
[2] F.M.F. de Groot, M. Nakazawa, A. Kotani, M.H. Krisch, and F. Sette, submitted to Phys. Rev. B.

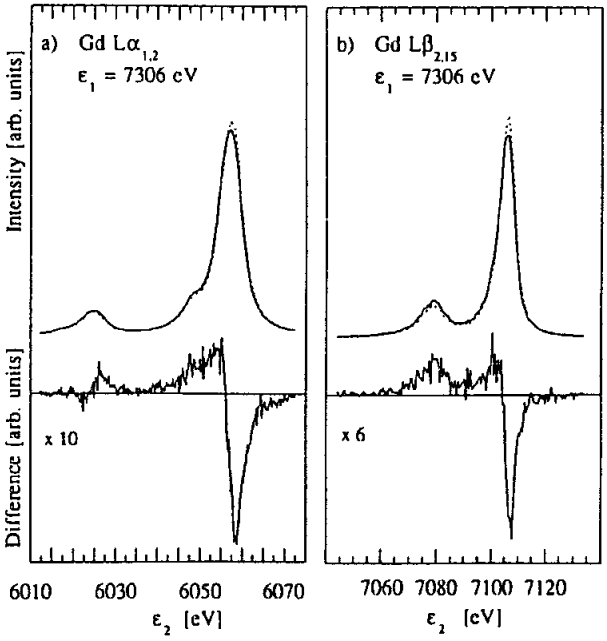

FIG. 1 - Resonant Raman scattering spectra of Gd metal for opposite circular polarization at the indicated photon energy ϵ_1. The spectra were normalised to the incident photon beam intensity, and taken with antiparallel (solid line) and parallel (dashed line) orientations between photon helicity and sample magnetization. The corresponding dichroic signals, obtained from the difference of the two top spectra (antiparallel minus parallel orientations), are displayed in the bottom panel after multiplication by the indicated factor: a) $L\alpha_1$ and $L\alpha_2$ emission lines and b) $L\beta_{2,15}$ emission line.

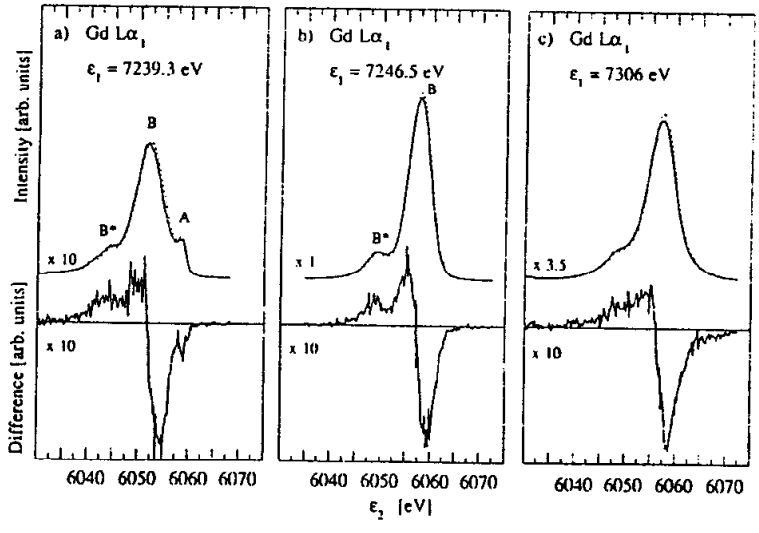

FIG. 2 - Normalized and self absorption corrected resonant Raman scattering spectra of the Gd metal $L\alpha_1$ emission line, taken at the indicated incident photon energies. The solid (dashed) line corresponds to antiparallel (parallel) orientation between photon helicity and sample magnetisation. The spectra are multiplied by the indicated scaling factor, due to the different Gd L_3- absorption coefficient at the considered incident photon energies. The dichroic signals are obtained taking the difference between the two spectra of opposite helicities and multiplying them by a factor of 10.