ESRF	**Experiment title:** Magnetic Structure and magneto-elastic coupling in RCu2-systems (R = Gd, Tb, Dy)	**Experiment number:** HE-485
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Names and affiliations of applicants (* indicates experimentalists):

A. Schneidewind*, T. Gleisberg*, M. Loewenhaupt Technische Universität Dresden

A. Hiess*, S. Kramp*, ILL Grenoble

Th. Reif*, FZ Jülich

M. Rotter*, E. Gratz Technische Universität Wien

Report:

The main topic of this experiment was to verify the magnetic structure of $GdCu_2$. The predestinated method for this question - neutron scattering - is very difficult to perform for Gd-compounds because of the large absorption of neutrons by Gd. One neutron powder diffraction experiment and one hot neutron single crystal experiment [1] opened fundamental informations about the magnetic structure. The observed magnetic intensities correspond to a magnetic ordering propagation vector of $\tau = (2/3\ 1\ 0)$. Using this and magnetization, thermal expension and magnetostriction measurements. A commensurate magnetic structure with antiferromagnetic modulation of the moments in *b* direction and cycloidal propagation of the moments in *a*-direction with a turning angle of 120 degrees was predicted

For the synchrotron experiment a $GdCu_2$ single crystal of about (1.21 x 1.655 x 2.3) mm^3 was used. It was orientated in vertical scattering geometry with *ac* scattering plane. Nonresonant scattering was performed at E = 7.2 keV below the Gd-L_{III}-edge, but with too weak intensities for searching a sufficient number of reflections. Resonant scattering at Gd-L_{II}-edge (E = 7.92 keV) allowed to investigate magnetic reflections at about 30 positions at the lowest availible temperature of about 10 K. The precision of the measured intensities is insufficient. One cause of this are deviations in the polarisation analysis angle. Secondly the beam size was little smaller then the sample surface and different grains have been irradiated at different positions. However differences of more then one magnitude between various reflections are found (Table 1). Magnetic dipole and quadrupole scattering was observed as well as a weak intensity of magnetic induced charge scattering. The magnetic wave vector of was found to be incommensurate in the *h* component: τ^*= (2/3+ ε_a 1 0). Concerning to the *k* and *l* components of the wave vector the resolution of the experiment was insufficient to see any deviation from the integer value. A temperaure dependence of the intensity was measured only for the (5 0 3)-τ reflection at the end of the experiment (Fig.1, Fig.2). This and the small variation of ε_a around the base temperature of the displex cryostat (Fig.3) do not indicate a transition into a commensurate magnetic structure. However such a transition is indicated by suszeptibility data [2] and has been found in other RCu_2-compunds (R = Nd, Dy, Tb).

Fig.1: Temperature dependence of the measured intensity of the (5 0 3)-τ reflection.
The increase at T = 10 K is not explained yet.

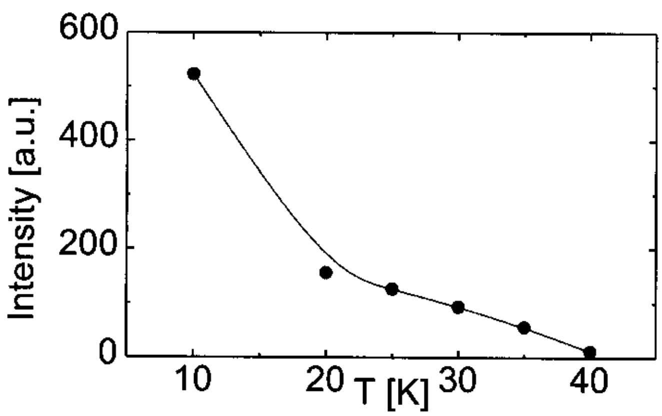
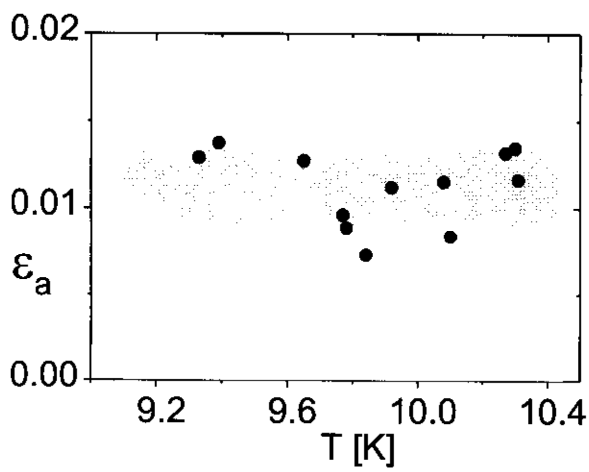


Fig.3: Variation of ε_a according to the variation of the regulated sample temperature. The gray area indicates the statistical error.



[1] ILL Experimental Report Nr. S-41-85 (D9, Nov. 1997)
[2] M. Rotter et al., Physica B, accepted
[3] E. Gratz, A. Lindbaum, JMMM 177-179, (1998) 1077

Fig.2: Temperature dependence of the (5 0 3)-τ reflection. From this data ε_a was calculated taking into account the anomalous thermal expansion [3].

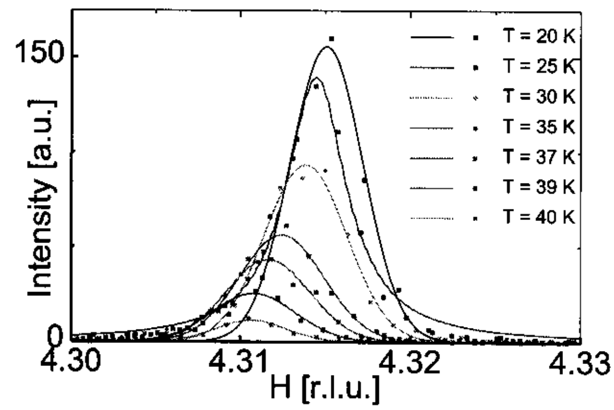


Table 1: Intensities of different magnetic reflections in $\sigma-\pi$ and $\sigma-\sigma$ polarization.

Position	Polarization	Energy [keV]	Intensity [a.u.]
(1.67 -1 1)	$\sigma-\pi$	7.932	0.0051
(2.33 -1 1)	$\sigma-\pi$	7.932	0.022
(2.67 0 2)	$\sigma-\sigma$	7.932	0.0017
(2.67 0 2)	$\sigma-\sigma$	7.2	no
(2.67 -1 2)	$\sigma-\pi$	7.932	0.023
(2.67 -2 1)	$\sigma-\pi$	7.932	no
(2.67 0 3)	$\sigma-\pi$	7.2	0.00025
(2.67 0 3)	$\sigma-\sigma$	7.2	no
(2.67 0 3)	$\sigma-\pi$	7.932	0.00086
(3.33 -1 0)	$\sigma-\pi$	7.2	0.0017
(3.33 -1 0)	$\sigma-\pi$	7.932	0.117
(3.33 -1 2)	$\sigma-\pi$	7.932	no
(3.33 -2 1)	$\sigma-\pi$	7.932	0.0039
(3.33 -2 1)	$\sigma-\sigma$	7.932	no
(3.33 -2 2)	$\sigma-\pi$	7.932	no
(3.67 -1 1)	$\sigma-\pi$	7.932	0.048
(3.67 -1 1)	$\sigma-\pi$	7.2	0.0029
(3.67 -1 1)	$\sigma-\sigma$	7.2	no
(3.33 -3 2)	$\sigma-\pi$	7.932	0.045
(3.67 -2 2)	$\sigma-\pi$	7.932	0.0225
(3.67 -1 3)	$\sigma-\pi$	7.932	no
(4.33 -1 3)	$\sigma-\pi$	7.932	0.09