ESRF	**Experiment title:** Resonant x-ray magnetic scattering from UGa_3	Experiment number: *HE-595*
Beamline: ID20	**Date of experiment:** from: 17/2/99 to: 23/2/99	**Date of report:** 24/2/99
Shifts: 18	**Local contact(s):** L. Paolasini	*Received at ESRF:*

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Report:

The present experiment, which finished one day before this report was submitted (!), had three aims. The first was to examine the energy dependence of the M_4 and M_5 resonances and see whether there was anything exceptional in that aspect. We successfully did that (Fig. 1) and the result is that the M resonances look very much like other uranium compounds, despite the fact that UGa_3 is an itinerant system with a moment of 0.8 μ_B/U atom.

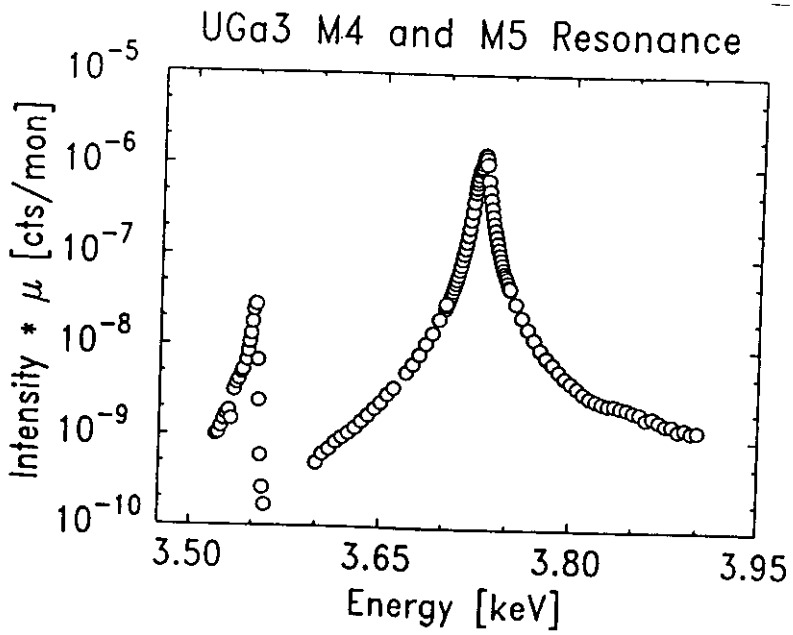

Figure 1
The M resonances of U in UGa_3 as measured at the (3/2,3/2,3/2) antiferromagnetic reflection.

The second object was to study the orbital to spin ratio by looking at the *non-resonant* magnetic scattering. This object has not been accomplished for 2 reasons (a) the discovery of a strong resonance at the Ga K edge (see below) and (b) the fact that neutron experiments, with a 5 T field applied on the sample, have been unable to determine the moment direction in UGa_3. Without this information, and in the presence of domains as certainly exist in the crystal, it is not possible to determine L/S.

The third object was to search for a resonance at the Ga K edge. This was a great success, and is the reason we are re-applying for beamtime so soon after the experiment. Shown in Fig. 2 is the integrated intensity (θ-2θ scans) as a function of energy for the (5/2, 5/2, 3/2) reflection. Non-resonance scattering at this refelction has been observed – it amounts to some 25 cts/sec in the σ → π channel. This level is indicated by a dashed horizontal line in the top part of Fig. 2. However, as the energy approaches 10.37 KeV (the tabulated value of the Ga K edge) a strong narrow resonance in the σ → π channel is observed. The intensity has reached ~ 10,000 cts/sec – the strongest K edge resonance ever observed on ID20!*This signal disappears at T_N with a T-dependence similar to that of the 5f moments.*

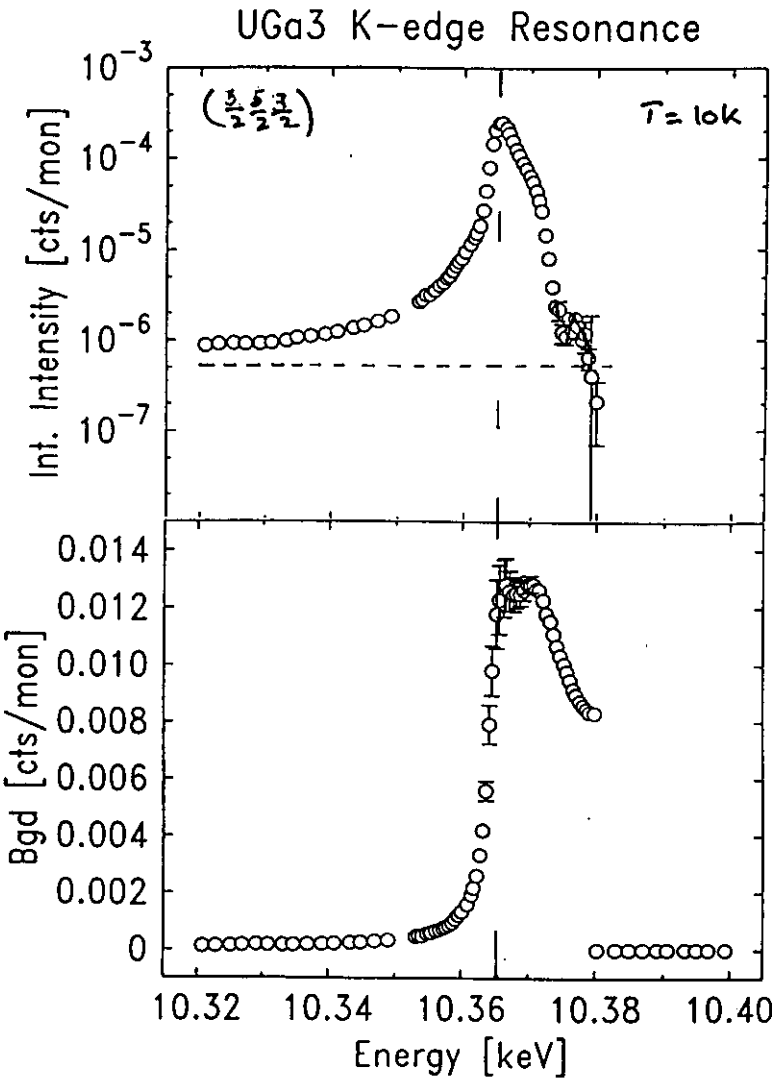

Figure 2
Energy dependence of the integrated intensity of the (5/2, 5/2, 3/2) reflection from UGa_3 near the Ga K edge (marked with a vertical dashed line). The enhancement over the non-resonant signal (marked with a horizontal dashed line) below the edge is ~ 1000. Notice the very narrow width of the resonance. The lower plot shows the background as deduced from the θ–2θ scans, and clearly shows the fluorescence at the edge.

We associate this resonance with dipole transitions from the core 1s states to the partially occupied 4p states. The 4p states are polarized by interaction with the 5f states.