ESRF	Experiment title: Resonant X-ray magnetic scattering at the M_4 and M_5 edges of UO_2. 28 JUN 2000	Experiment number: HE710
Beamline: ID20	Date of experiment: from: 17/11/99 to: 22/11/99	Date of report: 23/6/00
Shifts: 18	Local contact(s): D. Mannix*	*Received at ESRF:*

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Report:

From the first explaination of resonant x-ray magnetic scattering (RXMS), that was observed at the L absorption edges of Holmium, it was realised that the largest effects would be found in diffraction at the $M_{4,5}$ edges of the actinides. This is because large dipole transitions directly couple to the magnetic 5f states at these edges.

Recently, we have successfully determined the magnetic structure of NpO_2, taking advantage of the large XRMS at the M_4 edge of neptunium [1]. The magnetic structure of NpO_2 had remained unknown for the last 40 years, dûe to its small magnetic moment (~$0.01\mu_B$) and the lack of large enough singles crystals for neutron studies. Interestingly, the M_4 resonance in this material is very sharp and has a Lorentzian-squared profile in energy space, where one normally expects to find a simple Lorentzian. Here, we report on investigations of the M_4 and M_5 resonances of UO_2 using the same energy resolution (0.5eV) of the ID20 magnetic scattering beamline. The M_4 and M_5 resonances of NpO_2 and UO_2 are compared in **figure 1**. The sharp resonance is only observed at the M_4 edge of Np in NpO_2, UO_2 has the antipicated simple Lorentzian energy profile. The sharper M_4 resonance is therefore not a characteristic of the actinide dioxides and its origin still remains a mystery. Similar measurements, on the small moment heavy fermion compound URu_2Si_2 (~$0.02\mu_B$), additionally find a simple Lorentzian profile at the uranium M_4 edge. This result eliminates simple small magnetic moment arguements as the origin of the sharp profile in NpO_2.

References

[1] D. Mannix et al. Phys. Rev. B 60 15187 (1999).

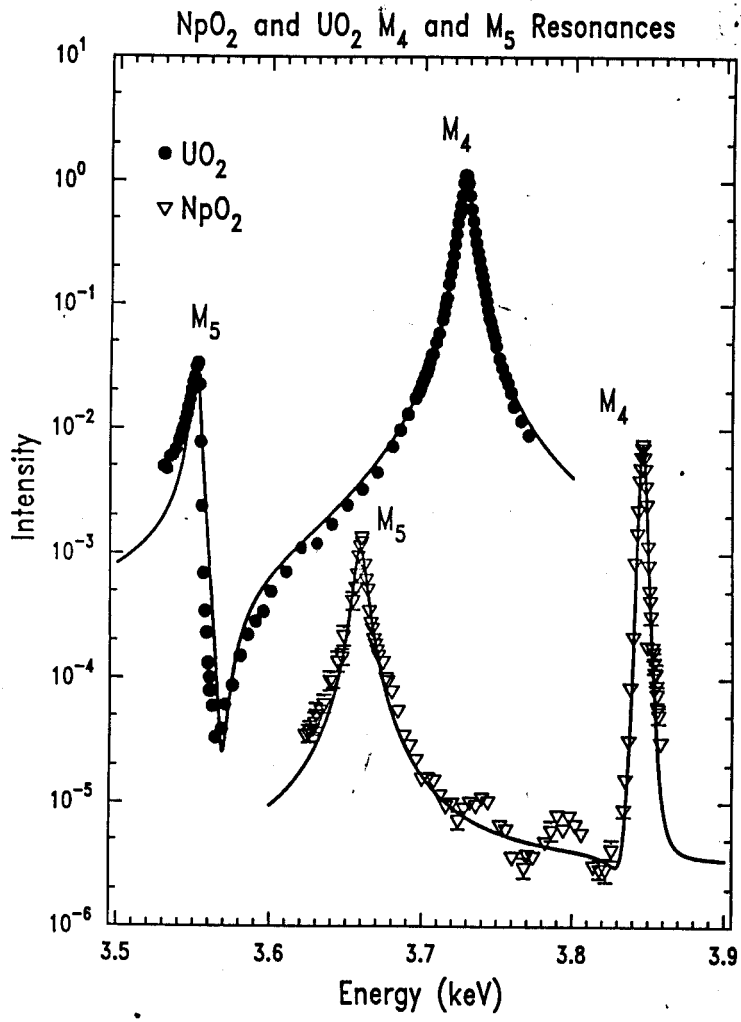

Figure 1. The RXMS at the M_4 and M_5 resonances of the actinide dioxides UO_2 and NpO_2. Only NpO_2 has a sharp energy profile at the M_4 edge, but a simpler Lorentzian shape at the M_5.