**Further RXMS Studies of the $Pu_xU_{1-x}Sb$ Series**

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**Introduction**: Following on from our first (successful) resonant x-ray magnetic scattering (RXMS) study of Pu-containing samples, made on $Pu_xU_{1-x}Sb$ for $x$ = 1.00 and 0.75 (Normile et al, 1999), measurements have been on a crystal of lower Pu concentration, $x$ = 0.5. One of the main motivations for this work was to investigate the resonance at the plutonium $M_5$ edge, since this was found to be "split" in $x$ = 0.75.

**Methods and Materials**: Measurements were made on a single-crystal sample of $Pu_{0.5}U_{0.5}Sb$ which was mounted using indium solder and encapsulated in Be - both as in the previous study ($x$ = 1.00 and 0.75).

$Pu_xU_{1-x}Sb$ crystallizes in the NaCl structure and $x \leq 0.5$ exhibit type I (k = 1) magnetic ordering (Normile et al, 1998) (isostructural with USb). Magnetic scattering from $x$ = 0.5 was thus searched for at the (003) position.

**Results**: An identical splitting to that found in $x$ = 0.75 (~ 10eV) is measured in $Pu_{0.5}U_{0.5}Sb$ – this is shown by the inset of Fig.1. The data of Fig. 1 includes the U $M_5$ resonance, which, unlike the Pu $M_5$, is clearly a single peak. Our previous study (x = 0.75) could not obtain a measurement of the U $M_5$ resonance due to poor incident flux at this energy. The present study thus allows us to obtain branching ratios for both U and Pu.

**Conclusions**: Pu $M_5$ splitting is a feature of the $Pu_xU_{1-x}Sb$ series. An explanation for this effect is lacking but could reside in a hybridization of the 5*f*, *j* = 7/2 states of Pu with the Sb 5*p* states. Alternatively, dichroism measurements made on U compounds (Dalmas de Réotier et al, 1999), which have shown a double lobe structure at the U $M_5$ edge, may provide us with a key to understanding the splitting of the Pu $M_5$ resonance. Splitting has never been observed at the U $M_5$ edge in any RXMS experiment. The reason for this could be the strong interference of the (tails of the) U $M_4$ resonance with the U $M_5$.

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**References**: Normile et al, "Resonant X-ray Magnetic Scattering Study of Single Crystal $Pu_xU_{1-x}Sb$", BNL Report (Beamline: X22C), 1999.
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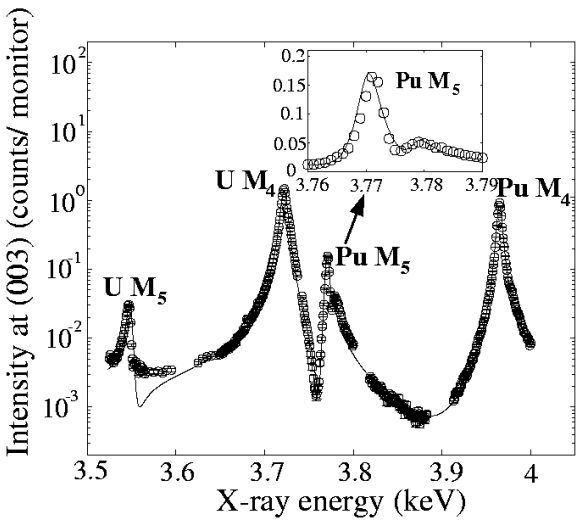


**Figure 1**. Peak intensity of the (003) magnetic reflection from $Pu_{0.5}U_{0.5}Sb$ as a function of the incident x-ray energy. The solid line is a fit to the standard dipole oscillator model (see, for example, McWhan et al, 1999).