XMaS	**Experiment title:** Magnetoelastic Interactions of the Multi-k Structures	**Experiment number:** 73
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Shifts: 1	**Local contact(s):** IHR	*Received at XMaS:*

Names and affiliations of applicants (* indicates experimentalists):

Matt Longfield* University of Warwick

J Whilmshurst* University of Warwick

G H Lander EITU

W G Stirling University of Liverpool

Report:

The neutron diffraction measurements of Kuznietz *et al.* [1, 2] have shown a rich series of magnetic structures for $x < 0.35$ with incommensurate phases near T_N and commensurate phases with $2k$ and $3k$ structures at lower temperature. In a series of x-ray magnetic scattering experiments we have studied the magnetic structures for the $0.1 < x < 0.4$ range of single-crystals. We have observed a new magnetic modulation for the $0.18 \leq x \leq 0.22$ range of mixed crystals. On cooling below 60K (T^*), an 'extra' magnetic satellite develops, which has an **incommensurate wave vector q_a~0.45 in the commensurate phase**. We have developed a *spin addition model* in which q_a=1/2(1-1/b), in analogy with the spin slip model of the lanthanides to describe this magnetic modulation. However, the origin of this new (q_a ~ 0.45) magnetic modulation remains unclear. One possible explanation for the extra magnetic satellite is the existence of an *interfacial region* caused by the coexistence of the $2q$ and $3q$ magnetic structures.

In this experiment we have carried out a systematic investigation of the lattice distortions induced by magnetoelastic interactions. **Figure 1** shows the transition from cubic to tetragonal symmetry of the crystal lattice of $UAs_{0.8}Se_{0.2}$ upon lowering the temperature. At 'high' temperatures in a paramagnetic phase scans about the (0, 0, 6) position show a single sharp Bragg reflection, and hence the crystal lattice has cubic symmetry. At lower temperatures the Bragg peak 'splits'. This is considered to arise from two different lattice reflections, which correspond to the a and c lattice parameters.

Figure 2 is a contour plot of this lattice distortion at 12K. The transition from cubic to tetragonal symmetry occours at temperatures for which a q~0.45 modulation of the commensurate phase has been observed, which is associated with a $2k$ to $3k$ structural stransition. To confirm the relationship between transitions of the crystal symmetry and the magnetic structure, we also studied the x=0.25 sample, which does not exhibit this unusual magnetic modulation. A contour plot of the (0, 0, 6) lattice reflection clearly shows that this crystal remains cubic. See **Figure 3**.

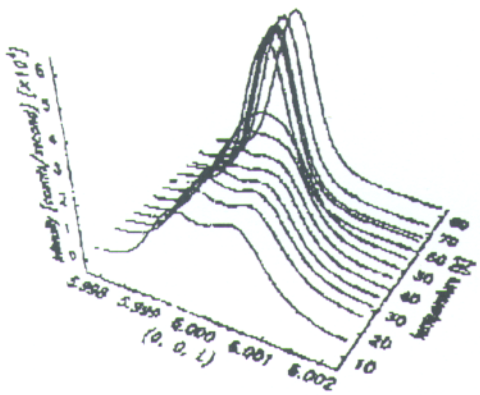

Figure 1: *Scans of the (0, 0, 6) lattice reflection upon lowering the temperature of single crystal UAs$_{0.8}$Se$_{0.2}$.*

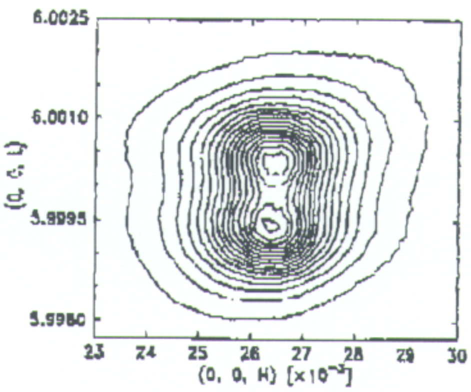

Figure 2: *A contour plot of the (0, 0, 6) lattice distortion at 12K, for x=0.2.*

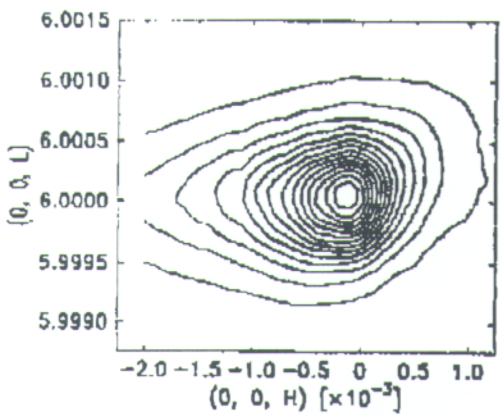

Figure 3: *A contour plot of the (0, 0, 6) reflection for x=0.25.*