ESRF	**Experiment title:** Resonant x-ray scattering on $U(As_{1-x}Se_x)$ solid solutions	**Experiment number:** HE - 72
Beamline: ID20	**Date of experiment:** from: 3/12/96 to: 10/12/96	**Date of report:** 25/2/97
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Report:

The present experiments have used the high flux of ID20 at the uranium M_4 edge to examine the details of the magnetism of the $U(As_{1-x}Se_x)$ solid solutions. These materials have the NaCl crystal structure and the interest is to follow the magnetism as a function of electron doping as x increases. We have used *exactly* the same crystals (or small pieces therefrom) as were used in the neutron study [1-2]. The brilliance of ID20 has meant that small (<0.5 x 0.5 x 0.1 mm) "flakes" can be used and these are found to have excellent mosaic properties, which in turn leads to fully exploiting the high-q resolution capabilities of ID20.

We have examined two samples, x=0.2, and x=0.4 in this initial study. We show in **Fig.** 1 some of the data taken from the x=0.2 sample for T < 60 K. This shows one of the most interesting findings; the development of an extra periodicity at low temperature. This peak has not been observed in neutron studies, probably because it is too weak (note the log scale of Fig. 1) and broad. We have also observed the behaviour near T_N (125 K) and measured the critical scattering. Quantitative fitting is in progress; in general the high-T behaviour appears much like that found with neutrons.

In **Fig.** 2 we show some of the interesting effects found in the x=0.4 sample. The wavevector (q) of this sample appears incommensurate, and changes regularly with temperature. This is in slight disagreement with the neutron findings, but could be due to either a "skin" effect (i.e. the wavevector being different at the surface) or a real difference in x between our small "flake" and the larger neutron sample. However, the interesting aspect is that both the longitudinal and transverse widths of the magnetic signal are *much* greater than the charge peak, and that they *increase* as the temperature is lowered. We believe this increase in the width, especially in the longitudinal direction, is a consequence of an unusual magneto-elastic interaction between the incommensurate magnetic order and the underlying lattice.

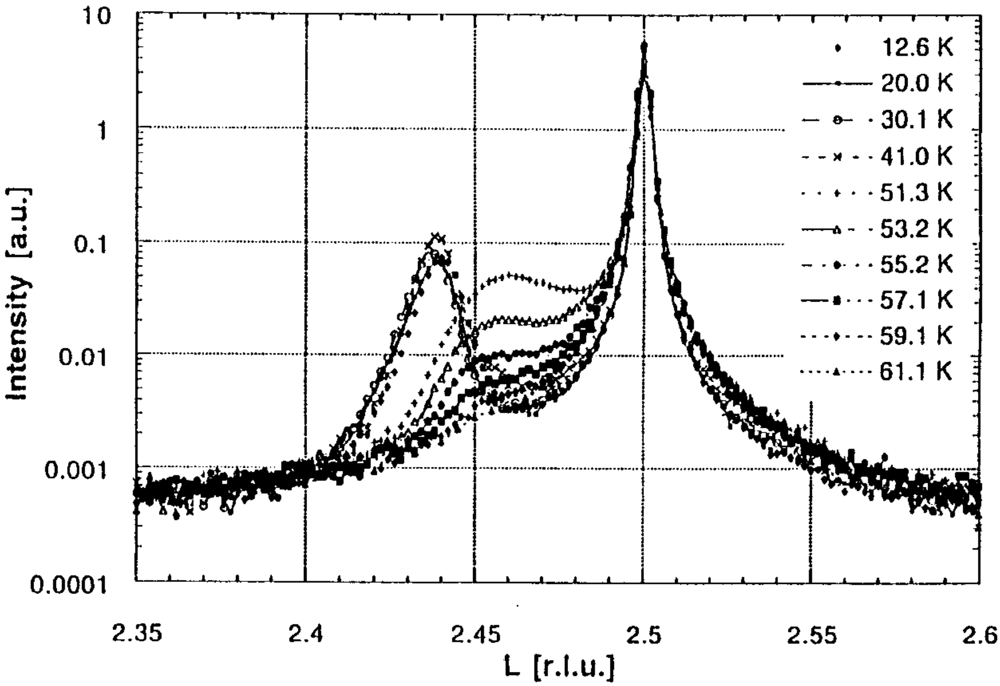
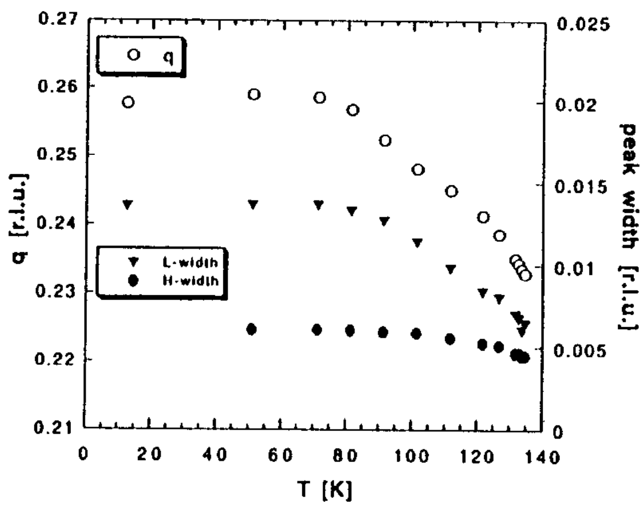


Fig. 1.
Experimental scans along the specular line [0, 0, L] around the magnetic peak L=2.5 as a function of temperature. The peak at L=2.5 corresponds to the commensurate ordering associated with the type-IA antiferromagnetic structure (a + + – – arrangement of uranium moments). The "extra" peak at ~2.44 is what we call a "super-periodic" modulation. Its full-width at half maximum (FWHM) is about 10 times greater than that of the peak at L=2.5. In real space this implies a much shorter correlation length for the q=0.44 modulation.

Fig. 2
Data from the x=0.4 sample. The wavevector q is shown as a function of temperature, as well as the longitudinal (L) and transverse (H) FWHM's. The q scale (open points) is on the left; the right-hand scale refers to the FWHM's - Longitudinal (triangles), Transverse (H-scans as solid points).



References:

[1] Kuznietz et al. J. of Less Common Metals 121, 217 (1986)

[2] Kuznietz et al., J. Magn. and Magn. Matls. 69, 12 (1987)