XMaS the UK-CRG	**Experiment title: Magnetic phase transitions and strain in $USb_{0.8}Te_{0.2}$**	**Experiment number**: 28-01-16
Beamline: BM 28	**Date of experiment**: from: 16-sept-98 to: 22-sept-98	**Date of report**: 15-april-99
Shifts: 17	**Local contact(s)**: Simon Brown	*Received at XMaS:*

Names and affiliations of applicants (* indicates experimentalists):

S P Collins* & D Laundy*
Synchrotron Radiation Department, CLRC Daresbury Laboratory, Warrington, WA4 4AD, UK

W G Stirling
Department of Physics, University of Liverpool, Liverpool, L69 3BX, UK

Report:

$USb_{1-x}Te_x$ exhibits a wide variety of magnetic phases as the tellurium concentration and/or temperature are varied [1]. In this work, we have studied the x=0.2 compound by resonant (Uranium M-edge) magnetic diffraction and non-resonant charge scattering. Figure 1 shows two distinct magnetic modulation wavevectors, corresponding to the ferrimagnetic and incommensurate phases. At T~170 K the two phases appear to coexists. While such coexistence was observed in earlier work [1], the temperature here is some ten degrees lower, possibly reflecting the strong dependence of sample composition on the ferrimagnetic to incommensurate phase transition. Magnetic ordering becomes ferromagnetic at lower temperatures, and undergoes a continuous phase-transition to a paramagnetic state above T_N~203.5 K.

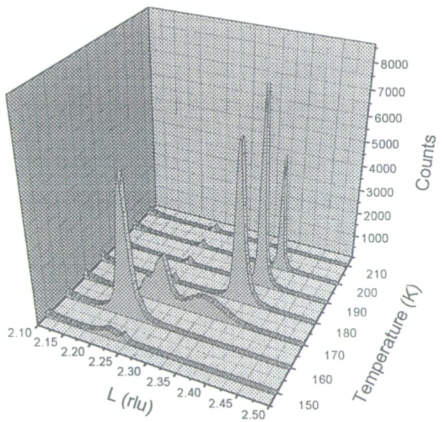

Figure 1. Ferrimagnetic (q~0.2) and incommensurate (q~0.4) phases in $USb_{0.8}Te_{0.2}$ **(M_4 resonance)**

Figure 2 shows magnetic scattering in the critical region with $T \sim T_N$. Fits to magnetic diffraction peaks above and below T_N have been used to extract critical exponents for (sub-lattice) magnetization, susceptibility and correlation length. All three exponents are close to those expected from a 3D Heisenberg magnet.

Measurements of M_4/M_5 branching-ratios and line shapes were performed over a wide of temperatures to investigate any possible variations with magnetic structure and magnetization. None was found within experimental errors.

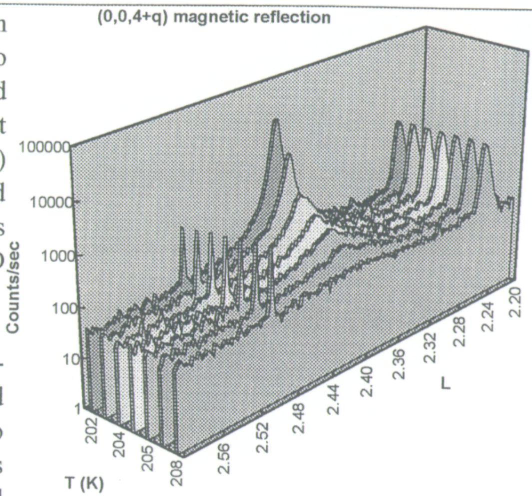

Figure 2. Critical scattering: incommensurate-to-paramagnetic phase transition (0,0,4+q)

The ferromagnetic phase is characterized by a rhombohedral distortion along one of the eight [111] easy axes. Figure 3 shows a reciprocal space map around the (004) Bragg peak. Although the distortion causes no change in d-spacing for this reflection, two distinct satellites, each of around 6% of the central peak intensity, appear in the direction of the surface. These weak peaks, which correspond to tilt-angles comparable to the rhombohedral lattice distortion, should provide information about the structure of magnetic domains in the sample surface.

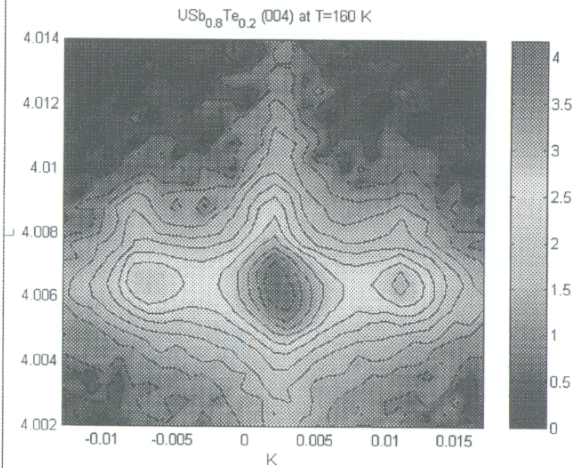

Figure 3. The (004) reflection in ferromagnetic phase (rhombohedral distortion)

References:

[1] W. J. Nuttall et. al. Phys.Rev. B **52, 4409 (1995)**