

ESRF

Experiment title:

Resonant x-ray magnetic scattering from actinide intermetallic compounds (LTP)

Experiment

number:

HE-818

Beamline:

ID20

Date of experiment:

from: 14/06/00

to: 20/06/00

Date of report:

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Shifts:

18

Local contact(s):

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Report:

This experiment started with the plan to examine single crystals of NpP. However, the initial attempts showed that the fine motors needed for alignment of these small samples were not working, and the experiment had to be abandoned. We then loaded crystal (B) of URu₂Si₂. This was a different sample to that examined in 1999, crystal (A). Sample A had a better polished face and thus a better mosaic.

Fig. 1 shows a comparison of the T dependence for this sample run in 2000 (sample B) with the earlier sample (A). The results are consistent, and also with those in the literature [Isaacs et al. PRL 65 (1990) 3185; B. Fåk et al. JMMM 154 (1996) 339]. A major objective of the experiment was to measure the *widths* of the magnetic peaks, which are related to the magnetic correlation lengths, see Fig. 2. For the first time we have shown that the magnetic correlations *change* below the nominal T_N of ~ 18 K.

Figure 1

Normalized integrated intensity as a function of temperature for the (005) AF reflection for URu₂Si₂. Results of integrations along [00L] are shown as circles, integrations along [0k0] are shown as triangles. Results from sample A (B) are shown as open (closed) points.

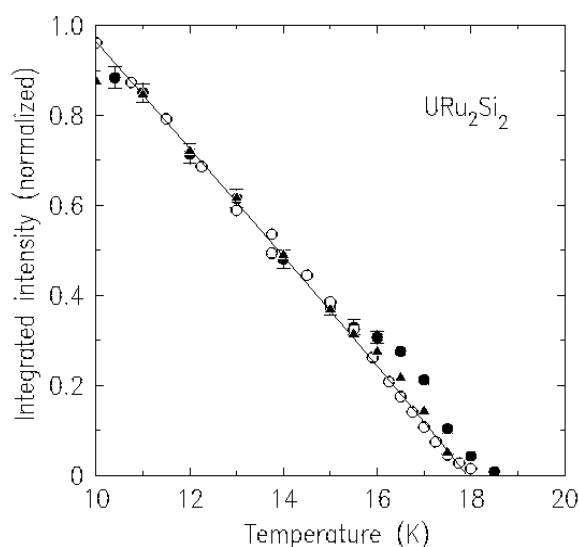
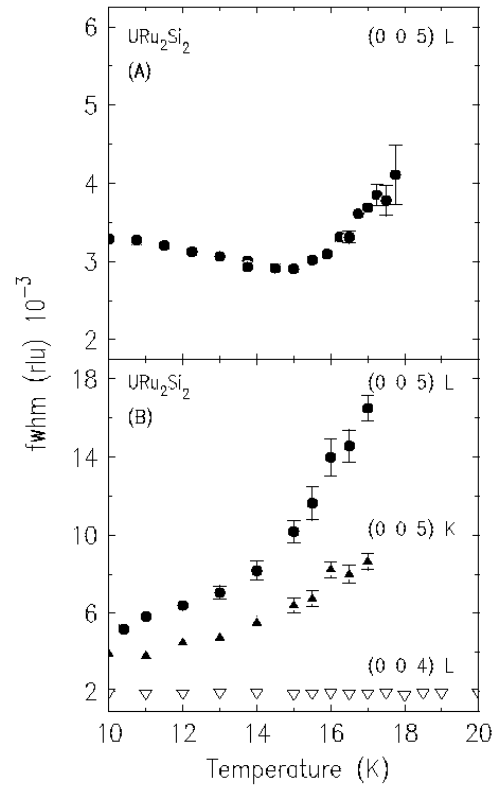


Fig. 2

Full-width at half maximum (FWHM) as a function of temperature for the magnetic reflections (005) (solid points) and the charge peak (004) (open points) for the two different samples of URu₂Si₂.



A most unusual effect was also noticed in the position of the magnetic peaks as $f(T)$. This is shown in Fig. 3. We believe the shift in the longitudinal position is related to the breaking of the symmetry by the surface when the peaks begin to broaden. A more complete study of this effect is underway. A publication on the results of this experiment is now in draft stage. An important conclusion, also using the results from the experiments (in June 1999) on the 5 and 10% Np doping, is that the resonance signal on the U site appears to originate from a dipole moment considerably larger (by approx. an order of magnitude) than that reported by neutron diffraction. We associate this difference to the different time interval of the two measurements, the RXMS one being much faster than that by neutrons.

Figure 3

The shift from the nominal position at $T = 10$ K as a function of temperature of the center of the reflections as measured in sample B of $x = 0$. Solid circles – L position from longitudinal scans of (005); solid triangles – transverse position K of the (005) reflection; dashed line – L position from longitudinal scans of the (004) charge reflection.

