



	Experiment title: Quadrupolar order in UPd ₃	Experiment number: HE-303
Beamline: ID20	Date of experiment: from: 8 July 98 to: 13 July 98	Date of report: 26 August 98
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Report:

The purpose of the experiment was to investigate the antiferro-quadrupolar order in UPd₃ that occurs below 7 K. Neutron scattering studies of quadrupolar systems are limited by the fact that there is no interaction between the neutron and a quadrupole within the dipole approximation. (The peaks that are observed in neutron scattering studies result from a lattice distortion that accompanies the quadrupolar order.) The situation for x-rays is less clear, but the same restrictions probably do not apply. It has been shown recently that x-ray resonant scattering may be used to study orbital ordering, a phenomenon closely related to quadrupolar order.

Our experiments on ID20 were very successful. In the time available we were able to characterize the energy and polarization dependence of the scattering for energies around the M_{IV} edge of U. The main results of our work are:

- Satellite peaks are observed at positions ($\frac{1}{2}$ 0 L), with L odd or even, in agreement with earlier neutron scattering experiments.
- Both types of peak display a resonance at the U M_{IV} edge.
- The L odd peaks rotate the incident polarization, whereas the L even peaks do not.

These results are summarized in the two figures below.

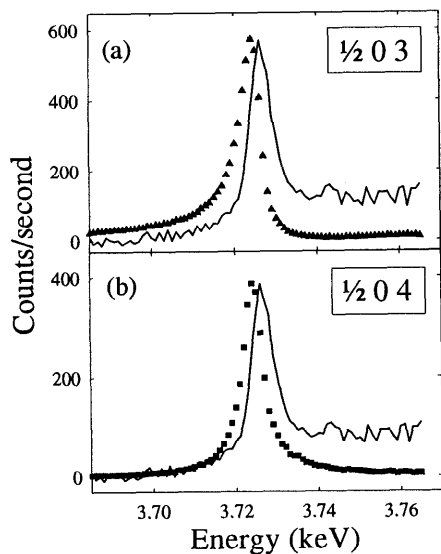


FIG. 1. Scans of the x-ray energy with Q held fixed at (a) \blacktriangle ($\frac{1}{2} 0 3$) and (b) \blacksquare ($\frac{1}{2} 0 4$). The data were taken at 1.6 K without an analyser crystal. The fluorescence measured in the background of the peaks in Q is shown as a solid line for comparison and has been scaled to the data in each case.

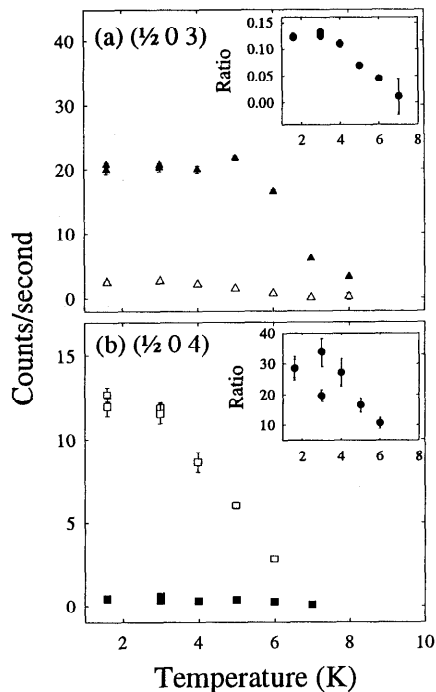


FIG. 4. The temperature dependence of the (a) ($\frac{1}{2} 0 3$) and (b) ($\frac{1}{2} 0 4$) peaks measured with the polarization analyser. For each peak the unrotated ($\pi - \pi$) (filled symbols) and rotated ($\pi - \sigma$) (open symbols) components of the scattering were measured. The insets show the intensity ratio of $\pi - \sigma$ over $\pi - \pi$.