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ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office using the **Electronic Report Submission Application:**

http://193.49.43.2:8080/smis/servlet/UserUtils?start

Reports supporting requests for additional beam time

Reports can now be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Charge and magnetic scattering in TbB_6 and Dyb_6.	**Experiment number**: HS-1733
Beamline: ID10A	**Date of experiment**: from: 03-avr-02 to: 09-avr-02	**Date of report**:
Shifts: 18	**Local contact(s)**: Dr. Federico ZONTONE	*Received at ESRF:*

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Report:

We performed normal Thomson scattering in the antiferromagnetic range of TbB_6 (T_N = 21 K) in order to find 4*f* multipolar and/or displacement wave satellites. From preceding results on CeB_6 and GdB_6 and the knowledge of the magnetic wave vector star, the search could be reduced around particular nodes of the reciprocal space. Indeed for a magnetic propagation vector, $\vec{k}$, belonging to the <1/4,1/4,1/2> star, satellites are expected at the following high symmetry points of the first zone boundary : (1/2, 0, 0), (1/2,1/2,0), (1/4,1/4,0), (1/4,1/4,1/2) and (1/2,1/2,1/2).

The sample, cut in order have a surface perpendicular to a [001] axis, was oriented with the [001] and [110] axes in the horizontal diffraction plane and then mounted inside a displex. The satellite search was performed at the lowest temperature reached by the displex, 12.5K. Satellites have been found with non-negligible intensities at $\vec{Q}_1 = \vec{H} + \vec{q}_1$ with $\vec{q}_1 = (0,0,1/2)$ and $\vec{Q}_2 = \vec{H} + \vec{q}_2$ with $\vec{q}_2 = (0,1/2,1/2)$. Despite a wide search in the reciprocal space, satellites associated with propagations (1/4,1/4,0), (1/4,1/4,1/2) or (1/2,1/2,1/2) were not found. In order to get the integrated intensity omega scans were performed for both types of satellites. The figure 1 shows omega scans performed for the (0,0,5/2) and (0,1/2,13/2) satellites at 12.5 and 25 K. At low temperature the satellites associated with the $\vec{q}_2$ propagation present an intensity one order of magnitude smaller than the satellites associated with $\vec{q}_1$. At 25 K, in the paramagnetic range the satellites have disappeared.

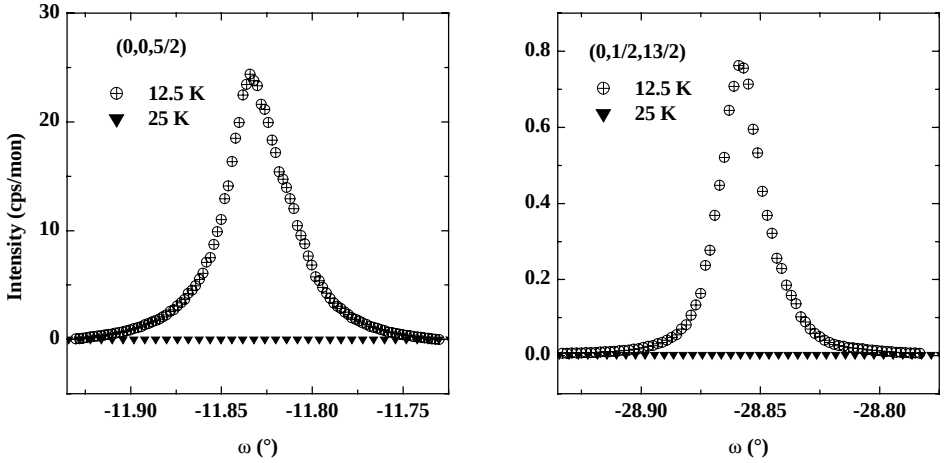

Figure 1 : *omega scans for the (0,0,5/2) and (0,1/2,13/2) satellites.*

The thermal variation of the intensity for the (0,0,13/2) and (0,1/2,13/2) reflections has been observed in the temperature range 12.5-25 K. As shown in figure 2 the integrated intensities for both reflections present exactly the same thermal dependance. This indicates that the two satellite families originate from an unique physical mechanism, intimately related to the stabilisation of the antiferromagnetic ordering at 21 K with a first-order type phase transition.

The satellite intensities present a very specific dependence as function of the scattering vector. This is illustrated on figure 3 for the specular reflections associated with the propagation $\vec{q}_1$

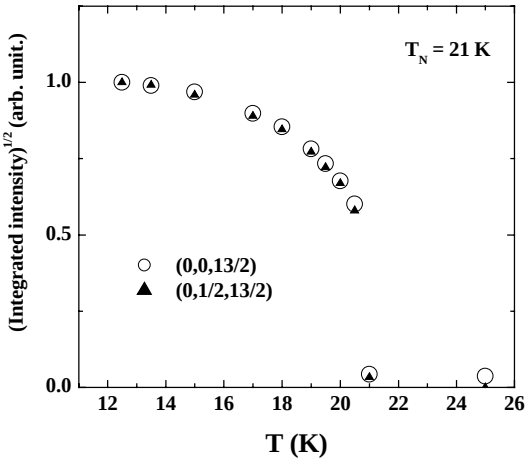

Figure 2: *thermal variation of the square root of the normalized integrated intensity.*

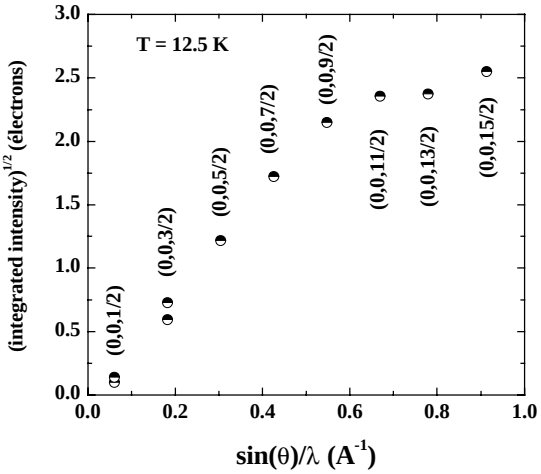

Figure 3 : *evolution with sin (θ)/λ of the square root of the integrated intensity for specular reflections associated with the* $\vec{q}_1$ *deplacement wave.*

Such a dependence can be expected assuming that the charge satellites originate from a rare earth displacement wave induced by a "exchange-striction" effect. Such an effect was introduced by T. Kasuya [1] as "exchange-pair Jahn-Teller" effects to explained the case of GdB_6. The knowledge of the actual magnetic propagation vector in TbB_6 allows now a quantitative analysis. The calculations are underway.

[1] T. Kasuya, J. Magn. Magn. Mater. 174 (1997) L28-L32.