EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

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 via the User Portal:

https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do

Reports supporting requests for additional beam time

Reports can 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:** Effect of the electric depinning of an incommensurate CDW on the phonon spectrum probed by inelastic X-ray	**Experiment number**: HC-3411
Beamline:	**Date of experiment**: from: 22.11.2017 to: 28.11.2018	**Date of report**: 20.02.2018
Shifts:	**Local contact(s)**: Alexei BOSAK	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

QUEMERAIS Pascal, MONCEAU Pierre, LORENZO Emilio, RODIERE Pierre : CNRS - Institut Neel
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Report:

Following measurements have been performed during the beamtime:

- Diffuse scattering (DS) in $TbTe_3$ and $ErTe_3$ as a function of temperature
- Diffuse scattering in $TbTe_3$ as a function of applied current at room temperature
- Inelastic scattering (IXS) in $TbTe_3$ as a function of temperature

Here we report the DS data for $ErTe_3$, as in this case we could cover two phase transitions associated to charge density waves (CDW).

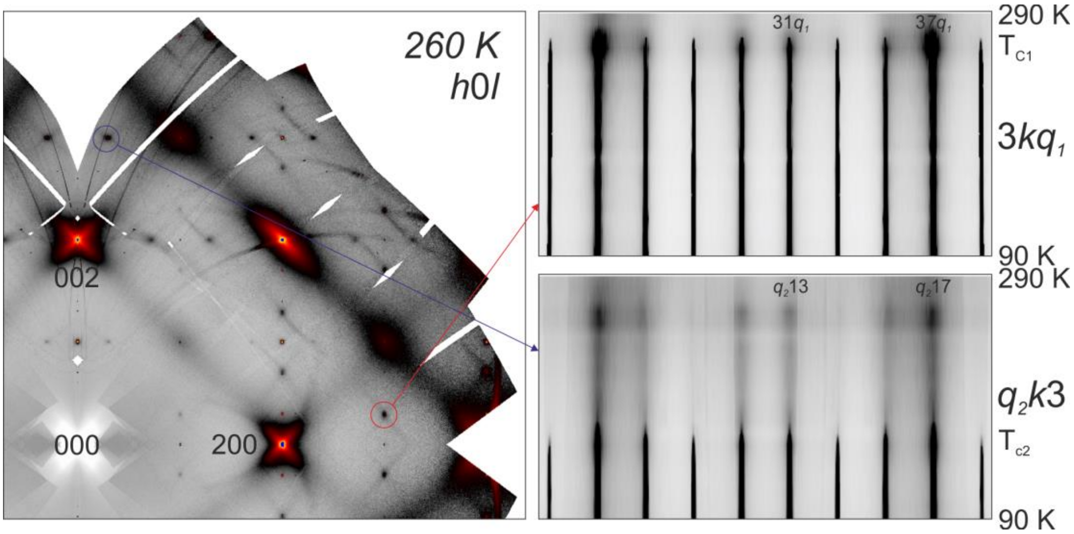

Figure 1. Reciprocal space section *hk*0 for ErTe3 at 260 K (left) and temperature dependencies of $3kq_1$ and q_2k3 intensities.

Left paned of Fig. 1 illustrates the observation of arc-like features and diffuse intensity spots, presumably both related to Fermi surface nesting features. Right panels of Fig. 1 shows the intensity evolution in the proximity of modulation spots. Remarkably, the intensity around $3kq_1$ spreads along b* both above and below the transition temperature T_{C1}, in line with the observation of phonon softening by M. Maschek et al. [1]. Remarkably, maximum of diffuse intensity is also observed in q_2 positions. Here $|q_1|$~0.3c* and $|q_2|$~0.3a*

Qualitative analysis of satellite intensities in low-temperature phase, including combined satellites, indicates that the low temperature modulation vector is rather (q_2 1 0) than previously reported (q_2 0 0). Otherwise, it can be accomodated by centering in 5D superspace group.

Figs. 2 and 3 illustrate IXS data taken in this experiment revealing the absence of softening at the approach of the phase transition. This result is in complete contradiction with that published in [1]. As a result we have decided to explore the phonon excitations in more details in order to gather a clear cut picture. The effect of the electric field on the charge density wave excitations is left to a forthcoming continuation proposal.

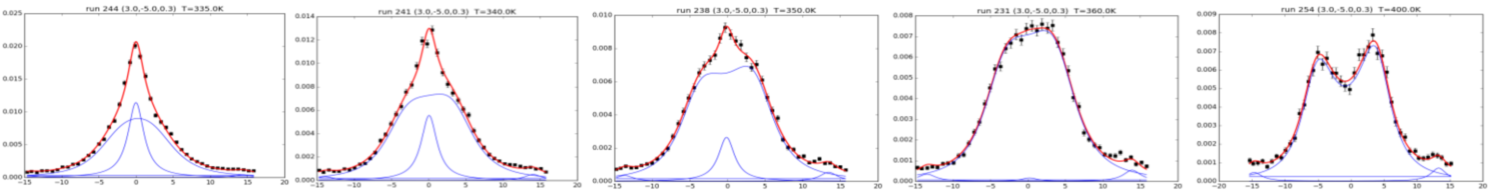

Figure 2. IXS data at the q_1 position at the approach of the phase transition (T_c = 330K). From left to right temperatures are 335K, 340K, 350K, 360K, and 400K. Contrary to what has been stated in [1] the measured profiles can be well accounted for by an increasing of the phonon damping rather than by the occurrence of a soft mode.

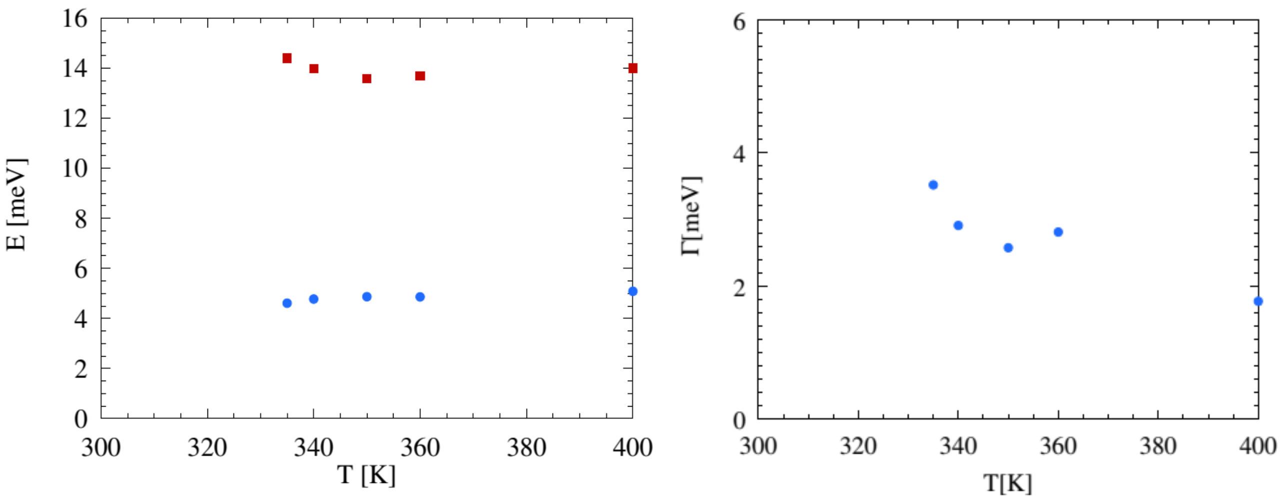

Figure 3. Temperature dependence of the energy (left panel) and of the dampind (right panel) extracted from the fittings of the data in Fig. 2

The current dependency of diffuse scattering in $TbTe_3$ was measured at ambient conditions employing compact setup shown on Fig. 4. The sliding of charge density waves was observed in current-voltage characteristics, though the effects on the diffuse scattering remain inconclusive, resulting from current-induced heating.

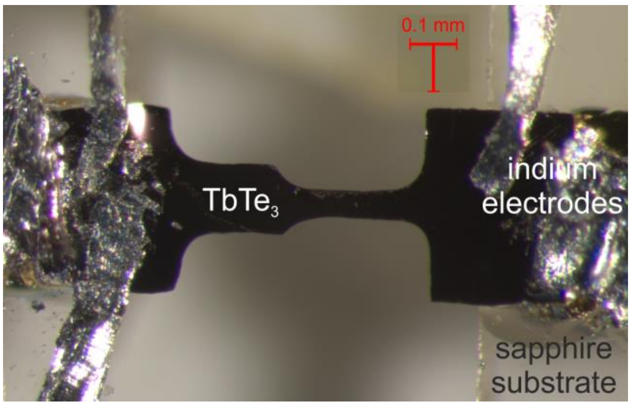

Figure 3. Setup for the measurement of DS under applied current.

Next step of present work is the CDW sliding study on $GdTe_3$, where T_{C1} ~380 K is well above ambient temperature and thus current heating can be nearly neglected.

[1] M. Maschek, S. Rosenkranz, R. Heid, A. H. Said, P. Giraldo-Gallo, I. R. Fisher, and F. Weber, Phys. Rev. B 91, 235146 (2015)