ESRF

ESRF	**Experiment title:** *Coherent diffraction of a screw dislocation of a Charge Density Wave under electric field.*	**Experiment number**: He1955
Beamline: ID01	**Date of experiment**: from: 09/11/05 to: 14/11/05	**Date of report**: 22/02/05
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Report:

The richness of the properties of Charge Density Waves (CDW) systems is directly related to the low dimensional character of their structure. Upon cooling, an electronic crystal is stabilized which can slide as a whole by applying an electric field greater than a threshold value.

As any crystal, the CDW is elastic and can exhibit intrinsic defects like dislocations. We have shown in a previous experiment, that coherent X-rays scattering were able to reveal the presence of CDW's dislocation (see ref [1], the experiment HE2402 and the corresponding report). Under coherent illumination, the incommensurate (6 0.249 –3.5) satellite reflection displays regular fringes, compatible with the presence of a single screw dislocation.

The detailed knowledge of these intrinsic CDW defects is essential for the understanding of the phase slip phenomenon, in which an amplitude defect grows and moves to create or destroy CDW phase fronts. Those topological defects are believed to play a central role in the sliding process of the CDW under electric field, including conversion of free carriers into condensed electrons, the variation of the CDW wave vector with temperature, or the CDW depinning under an electric field.

During our last experiment (HE1955 on ID01) last november, the same system ($K_{0.3}MoO_3$, or Blue Bronze) has been studied with a dc applied current current in order to observe the role of CDW dislocations in the sliding process. Unfortunatly, by lack of time (mainly due the difficulty to find a single dislocation, embedded at 3µm from the surface), this has not been done.

On the other hand, we have observed an extra modulation of the CDW under strong current. Indeed, for current larger than 10 times the threshold field, the incommensurate (6 0.249 –3.5) satellite reflection displays

regular satellites at 70K (see figure 1). The extra modulation corresponds to distances equal to 1.2µm (!) in the real space. This phenomenon is reproducible and is current dependent. This extra modulation of the incommensurate CDW which appears for large current could be due to local commensurability of the CDW wave vector. Since the CDW at low temperature is close to the commensurate value q = 0.25 along the chain axis b*, correlated zones with commensurate Q vector, embedded in incommensurate zones, could appear under large current.
An article is in preparation.

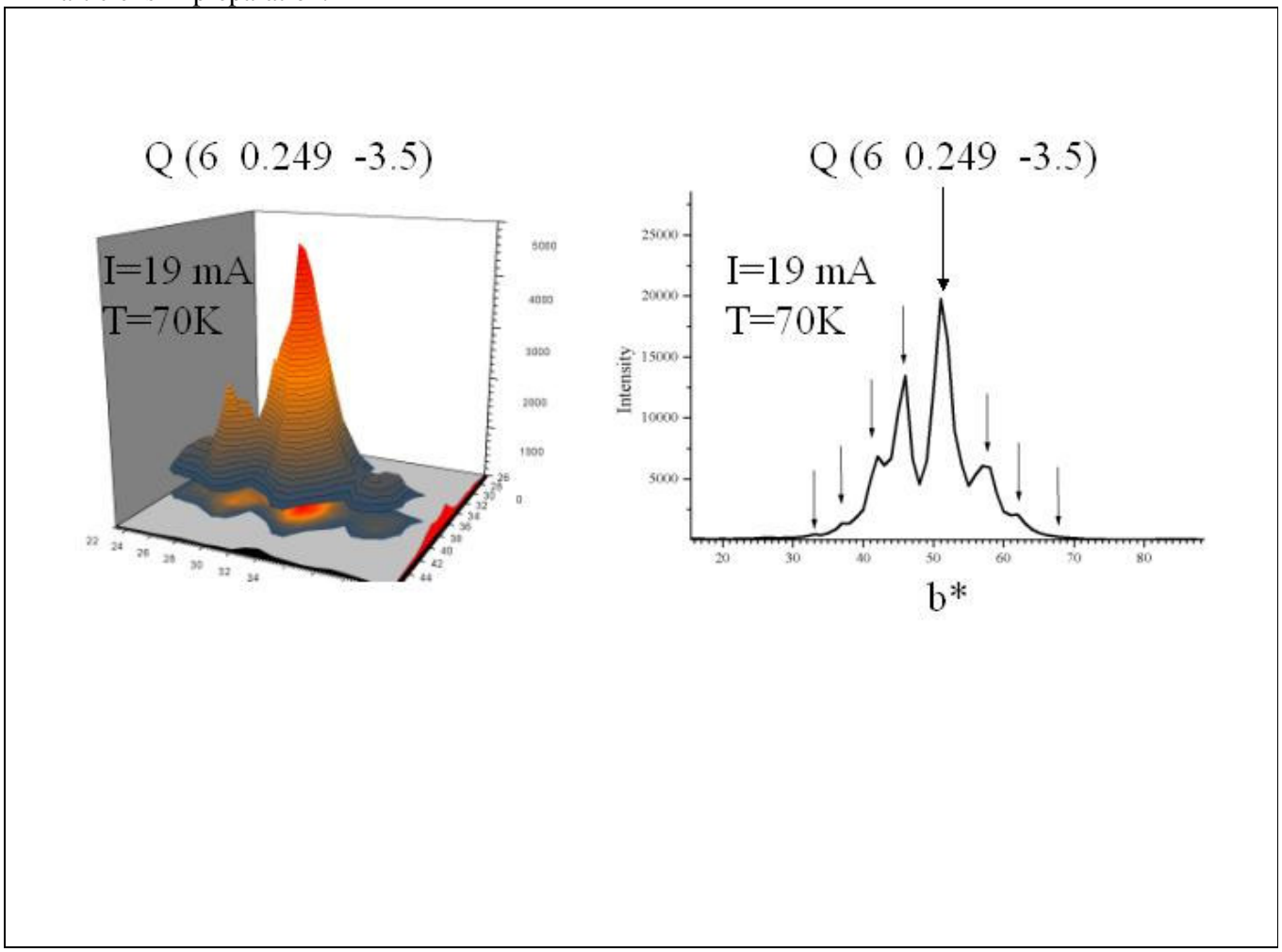

Fig1. Additional satellites appear along the chains axis b* of the CDW system under large electric current well above threshold Fourth order Satellites are visible.

Reference:

1. **Charge Density Wave Dislocation as Revealed by Coherent X-Ray Diffraction**
D. Le Bolloc'h, S. Ravy, J. Dumas, J. Marcus, F. Livet, C. Detlefs, F. Yakhou, and L. Paolasini
Phys. Rev. Lett. **95**, 116401 (2005) ; highlights ESRF 2006