ESRF	**Experiment title:** Sliding state of a quasi-2D CDW system probed by coherent X-ray diffraction	**Experiment number**: **HC-1746**
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Report:

We report of sliding Charge Density Wave (CDW) in the quasi two-dimensional $TbTe_3$ system probed by coherent x-ray difraction combined with *in-situ* transport measurements, performed at the ID01 beamline. We have shown how the CDW is directly involved in the non-linear transport properties. At the threshold current, the 2kF wave vector suddenly rotates and the CDW reorders by motion in the sliding state. In quasi one-dimensional systems, the CDW must disorder to overcome pinning defects through nucleation of abrupt CDW phase shifts. On the contrary, in two-dimensional systems like $TbTe_3$, the CDW does not display creep below threshold current and tolerates only slow space variations of the phase in the sliding state. This observation of collective transport of charges in 2D systems shows how an elastic object moves in the presence of disorder at the sub-micrometer scale.

The sliding state in $TbTe_3$ is reached thanks to a rotation of the $2k_F$ wave vector, probably to overcome pinning constraints, and a reordering of the CDW by motion. Despite the strong difference in dimensionality, the sliding state in $NbSe_3$ is also characterized by a deformation of CDW wave fronts and by a reordering by motion. However, the diffraction patterns in $NbSe_3$ strongly differ from those of $TbTe_3$. Contrary to $TbTe_3$, $NbSe_3$ displays speckles for very small currents which appear along a line in the reciprocal lattice, perpendicular to Nb chains. This corresponds to the presence of abrupt CDW phase shifts parallel to the chain axis and is compatible with a creep phenomenon (see Fig.3). The rotation of the 2kF wave vector seen in $TbTe_3$ was not measured in $NbSe_3$.

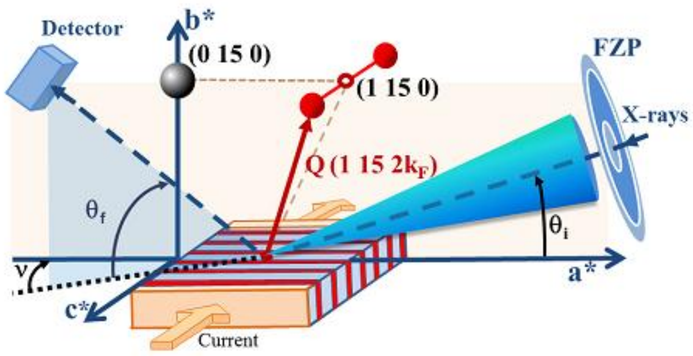

Figure 1: a) Experimental diffraction setup (not to scale) with a coherent 0:5µm 0:5µm focused x-ray spot. The (1 15 2kF) CDW satellite reflection, associated to the (1 15 0) Bragg (forbidden) Bragg reflection, has been probed with a 2D detector mounted on a lifting detector arm.

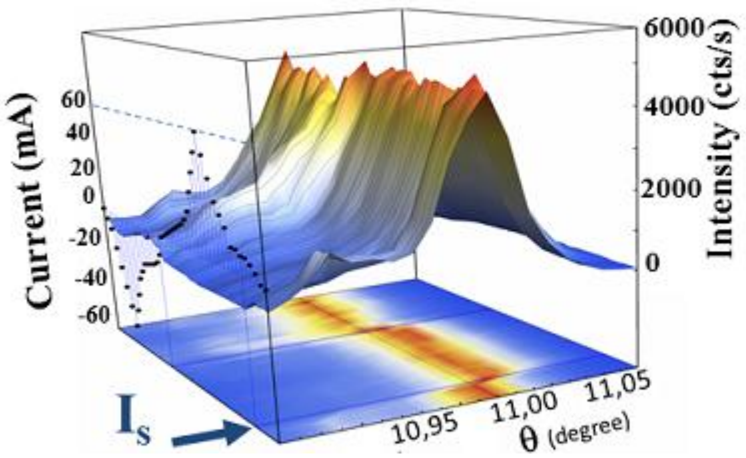

Figure 2: Rocking curve of the Q = (1 15 2kF) satellite reflection associated to the CDW in TbTe3 versus external current (T= 300K). The intensity corresponds to the sum over the whole pixel camera. The left panel corresponds to the current applied to the sample.

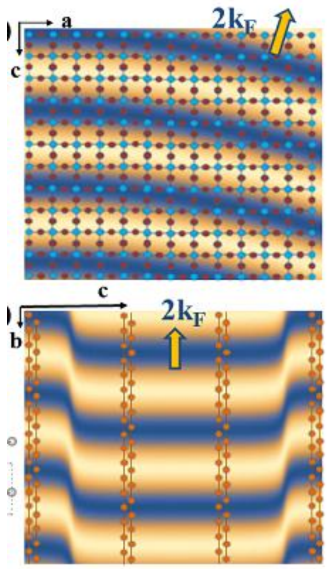

Figure 3: Comparison between CDW in TbTe3 (a quasi-2D system) and in NbSe3 (a quasi-1D system). The atomic structure is represented by colored cercles. The incommensurate CDW, with an excess of electrons, is represented by blue wave fronts.