ESRF	**Experiment title:** *Spin and Charge Density Waves in Chromium studied by coherent X-ray diffraction*	**Experiment number**: HE2170
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Report:

The goal of this experiment was to highlight the possibility to detect a phase defect such as a dislocation on the Spin Density Wave (SDW) of pure Chromium, using coherent X-ray diffraction. This technique has already been used to find such defects on the Charge Density Wave (CDW) of some compounds such as Blue Bronze $Rb_{0.3}MoO_3$ or $NbSe_3$. The difficulty with SDW reflection is their lack of intensity. Chromium is interesting because it exhibits both a CDW and a SDW, which are incommensurate with respects to the reciprocal lattice. Although Chromium has a 3D structure, the two density waves develop along a 1D direction. The sample we used was grown in order to be single-Q, which means it constitutes a single 1D domain for both the CDW and the SDW. These waves give rise to superstructures associated to each Bragg reflection. Besides, they appear below the Neel temperature which is T_N=311K and an optimum of intensity is reached around 140K for the SDW superstructure. In this temperature range, the SDW has a transverse polarization. It undergoes a spin-flip transition below T_{SF}=123K and hence becomes longitudinal.

Our study was limited to the transverse polarization, so we worked around 140K. We used non resonant magnetic scattering and worked at 5.90keV, just below the K-threshold of Chromium which is 5.95keV. The sample was mounted inside a He orange cryostat, with its (HK0) plane in the horizontal diffraction plane. The SDW reflection located at (0 0 1-δ), with δ≈0.03 has been observed with a CCD camera at different positions of the sample (see Figure 1). We performed diffraction maps with a 20µm beam. We can see on the first picture that the reflexion is splitted, which could be a signature of a phase defect in the probed volume. The splitting progressively disappears 20µm away from that location.

This measurement is consistent with the presence of an edge dislocation on the SDW, which is shown on a simulation we made (see Figure 2). However, we have to go further in our experiments to get a 3D image of the defect. Another feature to study is the relation between the SDW and the CDW. We have compared the domains in which they develop, but we have to do it more precisely to get clear conclusions.

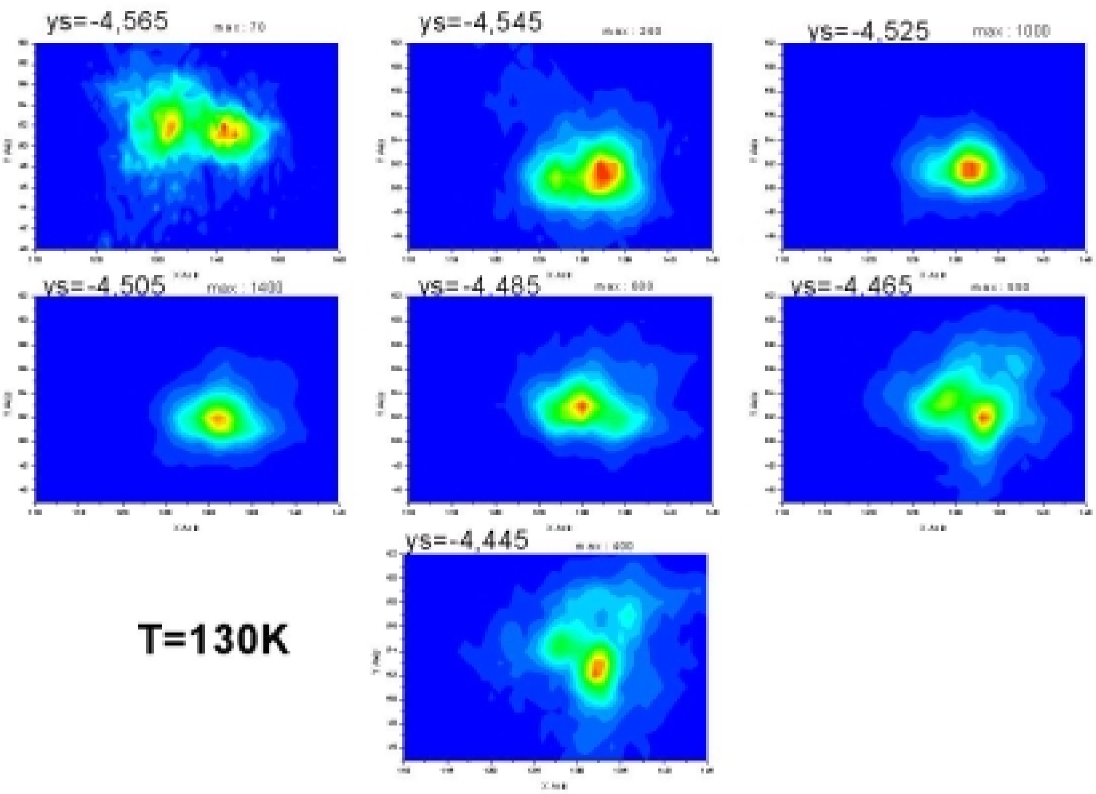

Figure 1: SDW (0 0 1-δ) reflection at different positions of the sample. There is a distance of 20µm between each map which corresponds to the diameter of the beam. On the first position, the peak is splitted, then the peak progressively becomes unique, and on the two last maps, we can distinguish a new splitting.

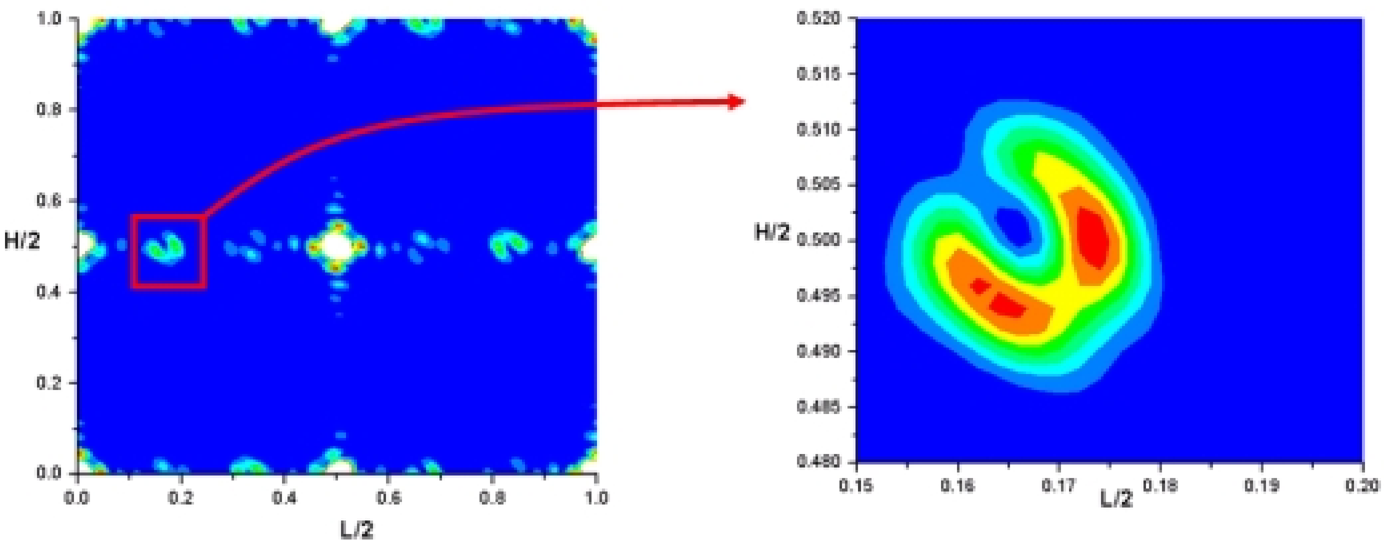

Figure 2: Simulation of the reciprocal space with an edge dislocation on the SDW. We get a splitting of the SDW peak which is consistent with our measurement.