



	Experiment title: Temperature dependent study of diffuse x-ray scattering due to charge stripes in High Tc superconductors and related materials	Experiment number: HS-309
Beamline:	Date of experiment: from: 08 Dec. 1997 to: 15 Dec. 1996	Date of report: 31.08.98
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Report:

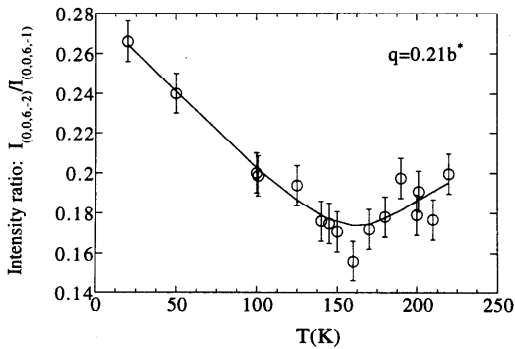
During the allocated time for the work, we continued the diffraction work for investigation of stripe structure of the CuO_2 plane that is becoming a hot topic during recent years and is getting known that this is relevant for the pairing mechanism in the high Tc superconductors that has been presented as a long term project on beamline ID11.

We have extended the work on the diffuse x-ray scattering in oxygen doped $\text{La}_2\text{CuO}_{4+\delta}$ to measure the variation of the second harmonics as a function of temperature in the range of 20-300K. This time we have exploited the newly installed charge coupled detector (CCD) with a Siemens kappa diffractometer on the beamline. We have followed the second harmonics of different superlattice modulations. From the temperature dependence and diffraction profiles we have distinguished the peaks due to oxygen ordering and peaks due to charge ordering in the superconducting planes. The second harmonics of the charge ordering has an anomalous increase below -150K with an increase from 19% to 26% of the first harmonics (Fig. 1). This indicates a stronger anharmonic lattice modulation associated with stripe formation in this compound below 150K. This is consistent with EXAFS data measured at ESRF [1].

This work provides a relevant contribution in the field since second harmonics are not detected in neutron scattering works. Moreover we can show that charge ordering as probed by dynamical lattice fluctuations at optimum doping is running in the diagonal direction while dynamical spin fluctuations appears in the horizontal direction (i.e. in the Cu-O-Cu direction).

The results have been presented at the second international conference on Stripes and High Tc superconductivity (STRIPES98) held at Rome during June 2-6, 1998.

The second experiment during the beamtime was performed on study of diffuse scattering on high quality samples of $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+y}$ system. These crystals are perfect stoichiometric for the metal elements and doping is controlled only by the interstitial oxygens. Thus the doping in this system is controlled by the mobile oxygen as in the case of $\text{La}_2\text{CuO}_{4+y}$. We have studied evolution of diffuse scattering only at one doping and in a limited temperature range. We found that the novel CCD detection system is quite suitable for our long term investigations of diffuse scattering in cuprate superconductors to solve the striped phases.



[1] *Temperature dependent modulation amplitude of the CuO₂ superconducting plane in La₂CuO_{4.1}* A. Lanzara, N.L. Saini, A. Bianconi, J.L. Hazemann, Y. Soldo, F.C. Chou, and D.C. Johnston **Phys. Rev. B** **55**, 9120-9124 (1997)

[2] *Charge Ordering in a High T_c Superconductor Doped with Interstitial Oxygen*, A. Valletta, N.L. Saini, A. Lanzara, A. Bianconi, P.G. Radaelli, P. Bordet, D.C. Johnston, P.C. Hammel, and Å. Kvik, Proc. Int. Conference on Stripes and High T_c Superconductivity, Roma 2-6 June, 1998 (**J. Superconductivity**, in press)