Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Superstructures in superconductors: The case of YBCO[1] ZAHIRUL ISLAM, Advanced Photon Source (APS), Argonne National Laboratory (ANL), X. LIU, S.K. SINHA, U. of California San Diego, J.C. LANG, APS/ANL, S.C. MOSS, U. of Houston, D. HASKEL, G. SRAJER, APS/ANL, B.W. VEAL, U. WELP, MSD/ANL, D. WERMEILLE, MUCAT-APS/ANL — Superstructures characterized by $\mathbf{q}=(q_x, 0, 0)$ are observed throughout the phase diagram of yttrium-barium cuprates ($YBa_2Cu_3O_{6+x}$, YBCO); $\mathbf{q}$ decreases with doping from $\frac{1}{2}$ (2-unit-cell) in the heavily un-derdoped compound to $\frac{1}{5}$ in the overdoped material. A 4-unit-cell superstucture is stable in the vicinity of optimal doping. The superstructures in YBCO correspond to short-range ordered regions of coupled atomic displacements on neighboring CuO, BaO, and CuO_2 planes, respectively. T-dependent measurements suggest that these "nanodomains" experience anharmonic thermal motion. These regions induce a long-range strain in the host, which manifests as "bow-tie"-shape Huang diffuse scattering below ∼200 K. X- ray diffuse scattering results will be presented within the context of the oxygen ordering and the phase diagram.

[1]APS is supported by DOE/BES, under Contract No. W-31-109-ENG-38.

Zahirul Islam
Argonne National Laboratory

Date submitted: 22 Dec 2004 Electronic form version 1.4