Doping dependent intrinsic line width of the Cu-O bond-stretching phonon with \( q=(0.25 \ 0 \ 0) \) in \( La_{2-x}Sr_xCuO_4 \)

S.R. PARK, University of Colorado at Boulder, A. HAMANN, L. PINTSCHOVIUS, KIT, D. LAMAGO, KIT; Laboratoire Leon Brillouin, CEA-Saclay, G. KHALIULLIN, MPI, M. FUJITA, K. YAMADA, Tohoku University, G.D. GU, J.M. TRANQUADA, Brookhaven National Laboratory, D. REZNIK, University of Colorado at Boulder — We have recently found that the charge inhomogeneities provide significant broadening in the Cu-O bond stretching phonon of \( La_{2-x}Sr_xCuO_4 \), and the line shape of the phonon at zone boundary is well reproduced by the simple model which takes charge inhomogeneous effect into account [1].

The question is, now, how large intrinsic line width of the phonon at \( q=(0.25 \ 0 \ 0) \), where the giant phonon softening and broadening exist [2], is apart from the charge inhomogeneous effect on the line width. In this talk, we will show the doping dependence of the intrinsic line width of the phonon from \( x=0.05 \) to \( x=0.30 \). Interestingly, the intrinsic line width as a function of doping follows the superconducting transition temperature. We will discuss relationship between the phonon and the superconductivity in \( La_{2-x}Sr_xCuO_4 \).