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Phonon renormalization reflecting dynamic charge inhomogeneity in copper-oxide superconductors D. REZNIK, L. PINTSCHOVIOUS, Forschungszentrum Karlsruhe, Institut für Festkörperphysik, P.O.B. 3640, D-76021 Karlsruhe, Germany, M. ITO, S. IIKUBO, M. SATO, Department of Physics, Division of Materials Science, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8602, Japan, H. GOKA, M. FUJUTA, K. YAMADA, Institute for Material Research, Tohoku University, Katahira, Aoba-ku, Sendai, 980-8577, Japan., G. GU, J. TRANQUADA, Condensed Matter Physics and Materials Science Department, Brookhaven National Laboratory, Upton, New York 11973-5000, USA — Our inelastic neutron scattering measurements show that there is a strong anomaly in the Cu-O bond-stretching phonon in cuprate superconductors $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ ($x=0.07,0.15$). This behavior also appears in superconducting $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$, however it is completely absent in undoped and overdoped LSCO. In $\text{La}_{1.875}\text{Ba}_{0.125}\text{CuO}_4$ and $\text{La}_{1.48}\text{Nd}_{0.4}\text{Sr}_{0.12}\text{CuO}_4$, compounds that exhibit spatially modulated charge and magnetic order, often called stripe order, the anomaly occurs at a wave vector corresponding to the charge order. The results suggest that this giant electron-phonon anomaly, which is absent in LDA calculations, is associated with charge inhomogeneity induced by strong electronic correlations. It follows that electron-phonon coupling may be important to understanding the superconductivity although its contribution to the mechanism is probably non-BCS-like.

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