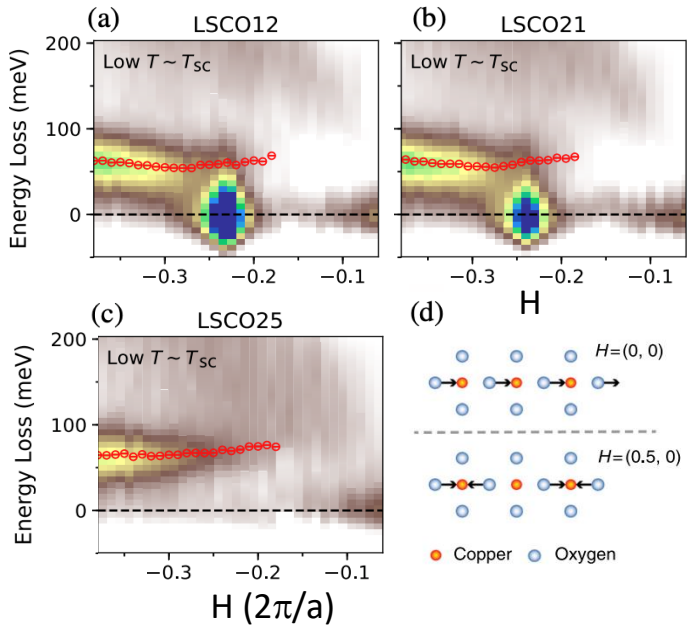
Superconductors and Charge Density Waves

(a)-(c) RIXS spectra of $La_{2-x}Sr_xCuO_4$ for (a) x=0.12, (b) x=0.21, (c) c=0.25. Red points are a fit to the phonon and the enhanced intensity around zero energy and H=-0.23. (d) Shows the atomic displacements involved in the phonon studied.



J. Q. Lin, H. Miao, D. G. Mazzone, G. D. Gu, A. Nag, A. C. Walters, M. García-Fernández, A. Barbour, J. Pelliciari, I. Jarrige, M. Oda, K. Kurosawa, N. Momono, Ke-Jin Zhou, V. Bisogni, X. Liu, and M. P. M. Dean. *Phys. Rev. Lett.* **124**, 207005.

Work was performed in part at Brookhaven National Laboratory

Scientific Achievement

Scientists showed that charge density waves form from electronic effects not lattice effects in cuprates, a special class of superconductors.

Significance and Impact

Understanding the origin of charge density waves is a central piece of the puzzle of high-temperature superconductivity, since the two have been shown to be closely interconnected. Superconductors are materials that can conduct electricity with almost zero resistance, which if realized at room temperature, has many applications.

Research Details

- Ultrahigh energy-resolution RIXS at the SIX beamline at NSLS-II was used to investigate a collection of samples of the cuprate $La_{2-x}Sr_xCuO_4$.
- Data indicate little or no direct coupling to the electronic transitions and, therefore, that the charge density wave is generated by strong correlations and a phonon response.