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【170】Interplay between phonon and charge density wave in Superconducting $La_{1.675}Eu_{0.2}Sr_{0.125}CuO_4$

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We conducted a resonant inelastic X-ray scattering (RIXS) experiment at the O-K edge on $La_{1.675}Eu_{0.2}Sr_{0.125}CuO_4$, leveraging RIXS's high resolution to study charge density wave (CDW) and its interaction with phonons in cuprate superconductor. Three phonon modes are detected in the RIXS spectra, which are assigned to the bond-stretching, bond-buckling, and an acoustic phonon mode respectively. The low-lying acoustic mode displays a sharp peak of spectral weight at $q \sim 0.25$, slightly larger than the CDW wavevector $Q_{\mathrm{CDW}} \sim 0.23$. Meanwhile, no significant softening of this phonon mode is observed, suggesting a weak interaction between charge and phonon excitation. These results are well explained by our theoretical model within the weak-coupling framework.

Theoretical Work

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