

Sliding Phononic Gaps in the Charged Incommensurate Planes of Sr₁₄Cu₂₄O₄₁

Monday, 23 July 2012 20:00 (2 hours)

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The terahertz (THz) excitations in the quantum spin-ladder system Sr₁₄Cu₂₄O₄₁ have been determined along the c-axis using infrared, Raman and THz time-domain spectroscopy. Low-frequency infrared and Raman active modes are observed above and below the charge-ordering temperature $T_{co} \sim 200$ K over the narrow interval of 1 - 2 meV. A new infrared mode around 1 meV develops below 100 K. The temperature dependence of these modes shows that they are coupled to the charge- and spin-density-wave correlations in this system. These low-energy features are conjectured to originate in the gapped sliding-motion of the chain and ladder sub-systems, which are both incommensurate and charged.

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Session Classification: Poster Session 1

Track Classification: Correlated Physics