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Unusual giant negative thermal expansion in La-doped $CaFe_2As_2$ superconducting single crystal[1] ALWYN REBELLO, JOHN J. NEUMEIER, Montana State University, ZHAOSHUN GAO, YANPENG QI, YANWEI MA, Chinese Academy of Sciences — Large negative thermal expansion (NTE), wherein a material substantially shrinks on heating, is a phenomenon that occurs only in very rare materials.[2,3] Here we present results on anisotropic and unusually large NTE in single crystalline $Ca_{0.8}La_{0.2}Fe_2As_2$ (CLFA), a recently discovered high temperature superconducting material. The volume thermal expansion coefficient in CLFA remains negative over the entire measured temperature range and reaches a maximum of $\Omega = -90 \times 10^{-6}$ K^{-1} near 65 K, which is remarkably large compared to the thermal expansion (TE) of most other materials. Furthermore, we do not observe signatures of any structural transition in the linear TE in the a, b and c axes. Our results on TE and heat capacity behavior in the vicinity of superconducting transition temperature ($T_C = 42.7$ K) indicate non-bulk superconductivity in the sample. The observed large NTE in our sample is attributed to anomalous transverse modes which may vibrate in a quartic potential as in ScF_3.[4]

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[2]T. A. Mary et al. Science, **272**, 90 (1996)
[3]G. D. Barrera et al. J. Phys.: Condens. Matter, **17**, R217 (2005)
[4]C. W. Li et al. Phys. Rev. Lett., **107**, 195504 (2011)

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