Abstract Submitted
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Microscopic theory of coherent phonon spectroscopy of carbon nanotubes[1] G.D. SANDERS, C.J. STANTON, University of Florida, J.K. KIM, K.J. YEE, Chungnam National University, Y.S. LIM, Konkuk University, E.H. HAROZ, L.G. BOOSHEHRI, J. KONO, Rice University, R. SAITO, Tohoku University — Using pump-probe spectroscopy with pulse shaping techniques, we study coherent phonons in chirality-specific semiconducting single-walled carbon nanotubes. The signals are resonantly enhanced when the pump photon energy coincides with an exciton resonance, and provides information on the chirality-dependence of light absorption, phonon generation, and phonon-induced band structure modulation. We develop a microscopic theory for generation and detection of coherent phonons in carbon nanotubes. We find that coherent phonon amplitudes satisfy a driven oscillator equation with a driving term depending on photoexcited carrier density. We compare theory with experiment and find that our model predicts correct overall trends in the relative strength of the coherent phonon signal both within and between different mod(n-m,3)=2 families. We predict that phonon intensities are considerably weaker in mod(n-m,3)=1 tubes in comparison with mod(n-m,3)=2 tubes, also in agreement with experiment.

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