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Theory of coherent phonons in carbon nanotubes and graphene nanoribbons[1] G.D. SANDERS, C.J. STANTON, University of Florida, A.R.T. NUGRAHA, R. SAITO, Tohoku University — We have performed theoretical studies on generating and detecting coherent radial breathing mode (RBM) phonons in single-walled carbon nanotubes and coherent radial breathing like mode (RBLM) phonons in graphene nanoribbons. A microscopic theory incorporating electronic states, phonon modes, optical matrix elements, and electron-phonon interaction matrix elements allows us to calculate the coherent phonon spectrum. The coherent phonon amplitudes satisfy a driven oscillator equation with a driving term that depends on photoexcited carrier density. We study the coherent phonon spectrum for nanotubes of different chirality and for armchair and zigzag graphene nanoribbons. We compare our results with a simpler, effective mass theory where we find reasonable agreement with the main features of our computed coherent phonon spectrum.

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