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Focusing of High Wavevector Phonons[1] J J BIBLE, R E CAMLEY, UCCS BioFrontiers Center, University of Colorado at Colorado Springs — In isotropic materials, energy leaving a point source often spreads out uniformly in all directions. In contrast, in materials that are anisotropic the energy can sometimes leave the source in narrow beams, known as caustics. In elastic materials, this is known as phonon focusing and has been studied in the long-wavelength limit both experimentally and theoretically. Surprisingly there have been very few studies of focusing with high wavevector phonons, where the wavelengths are short enough that they see the lattice structure. We show that this effect leads to focusing of high-wavevector phonons even though long wavelength waves are not focused. We use both analytic and numerical methods. The numerical model, a system of coupled atoms in two dimensions, allows us to explore new features. We study the effect of impurities in the system, nonlinear effects, and the decay of the intensity with distance from the source. We find that at short distances the intensity varies as r^{-n} where n ranges from .56 to .69. This is in contrast to the far field limit which has $n = 1$. Furthermore, small nonlinear coefficients lead to significant changes in the focusing pattern of the system.

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