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Title
Theory of coherent generation and detection of THz acoustic phonons using optical microcavities
Source
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Abstract
The coherent generation and detection of acoustic phonons in a superlattice embedded in an optical microcavity is theoretically analyzed. In this optical resonator, femtosecond light pulses can be spatially confined and amplified. We show that the acoustic phonon generation is enhanced as the intensity of the incident electromagnetic field is amplified in resonance with the optical microcavity. The detection process is also enhanced by the optical resonator. In the case of real photoelastic constants the maximum sensitivity occurs when the probe wavelength is tuned to where the derivative of the reflectivity has its maxima, at the optical cavity mode edges. We also analyze the role of the imaginary part of the photoelastic constants of the structure in the generation and detection processes. Finally, we study the enhancement efficiency of the microcavities when the coherent generation and detection are optimized simultaneously; we estimate phonon signals up to six orders of magnitude higher than the ones obtained with the superlattice without optical confinement. (42 References).