Strong amplification of coherent sub-THz acoustic phonons in superlattices. 
Fashioning and Pumping up the sound and the SASER issue

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We present and demonstrate\(^{(1)}\) a novel concept and scheme of acoustic phonon amplification at sub-THz frequency and a few nanometers wavelength range based on the photodriven acoustoelectric (AE) effect\(^{(2)}\) with 100fs light pulses in an electrically biased semiconductor superlattice (SL) GaAs/AlGaAs; the amplification is due to stimulated Cerenkov folded zone ac-phonon\(^{(3)}\) emission by electrons undergoing intra-miniband transport. The process is accounted for with a detailed theoretical model and extensions are discussed.

With appropriate phononic microcavity configuration it can allow the realization of the SASER (Sound Amplification by Stimulated Emission of Radiation) operation\(^{(4)}\), the analogue of the laser with sound. In the present configuration it is the analogue of the quantum cascade laser with sound in the sub-THz frequency and a few nm wavelength range. Such a coherent phonon source allows for investigations with very high spatial resolution, almost comparable to that of an electron microscope, e.g. in microelectronic devices or in microbiology.