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* (***S**ound **A**mplification by **S**timulated **E**mission of **R**adiation*) 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.

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