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Anisotropy of plasmon-phonon coupling under intense optical excitation of GaAs.[1] AMLAN BASAK, HRVOJE PETEK, University of Pittsburgh — The dependence of coherent optical processes in time-frequency domain on the polarization of pump and probe beams can shed light on different generation and detection mechanisms. Here, we report the response of (100) oriented n-doped GaAs (n_d=2x10^{18}cm^{-3}) when excited to an e-h pair density n_{exc} ~10^{18}-10^{20} cm^{-3} with a 10 fs laser pulse centered at 400 nm. Experiments are performed in the transient reflectivity and reflective electro-optic sampling geometries with various pump and probe orientations. Time domain signal showing plasmon-phonon oscillations has a weak pump polarization dependence indicating isotropic generation mechanism and strong probe polarization dependence revealing symmetry properties of various carrier-phonon interaction mechanisms. Fourier Transform analysis of the time domain signals at different probe orientations show both plasmon and phonon anisotropy. Results are discussed considering different possible carrier-phonon interaction mechanisms with different symmetry dependences. Frequency evolution of plasmon-phonon coupled mode with increasing photoexcited carrier density is consistent with the hole-phonon coupling in the high damping regime.

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Amlan Basak
University of Pittsburgh

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