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Ultrafast carrier-phonon dynamics under intense optical excitation of GaAs AMLAN BASAK, Univ of Pittsburgh, M. HASE, Univ of Tsukuba, M. KITAJIMA, NIMS, Tsukuba , HRVOJE PETEK, Univ of Pittsburgh — We report the response of n-doped GaAs (n_d=2x10^{18} cm^{-3}) when excited to an e-h pair density n_{exc} ~10^{19}-10^{20} cm^{-3} with a 10 fs laser pulse centered at 400 nm. The experiment is performed in reflective electro optic sampling geometry. Coherent LO phonon oscillation is excited through both ultrafast screening of the depletion field and the deformation potential scattering. The time domain signal contains near-instantaneous transient electronic response as well as coupled plasmon-phonon oscillation. The amplitude of reflectivity is sub-linear possibly indicating saturation of the screening effect with excited carrier density. Fourier Transform analysis shows the bare LO phonon and the lower branch of the LO phonon-plasmon coupled modes (L-). With increasing photocarrier density, the LO phonon response is essentially unaffected, while the L- peak red shifts to the TO phonon limit. Time windowed FT analysis reveals complex carrier density dependent spectral evolution. The coupled carrier-phonon dynamics are discussed in the context of deformation potential scattering and high field transport.

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