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Electron-Phonon Kinetics and Transport in 2D Structures of Reduced Electron Concentrations[1] ANDREI SERGEEV, SUNY at Buffalo, MICHAEL REIZER, VLADIMIR MITIN, SUNY at Buffalo — Usually, screening of the electron-phonon (e-ph) interaction is considered in linear approximation. In this case in 2D systems, the Debye screening radius r_D is independent on the electron concentration, n. The linear approximation ignores the discreteness of the electron charge and it is not applicable for diluted systems. Here we show that the screening radius for e-ph interaction is in fact $\max(r_D, n^{-1/2})$. For this reason, e-ph interaction is drastically enhanced in the diluted systems. In particular, a value of the deformation potential is increased by a factor of $n^{1/2}/r_D \approx R_s/a_0 = r_s$. The suggested approach explains puzzling data [1], which demonstrate that the deformation potential between holes and phonons in dilute 2D GaAs is twenty times stronger than expected from the theory. Strong coupling increases all e-ph phenomena. Using the Keldysh diagrammatic technique, we calculate kinetic and transport characteristics for diluted 2D systems. [1] X.P.A. Gao et al, Phys. Rev Lett. 94, 086402 (2005).

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