Electron decoherence in a semiconductor due to electron-phonon scattering

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A quantitative analysis of the electron decoherence is performed in the case where an electron interacts with an environment consisting of a phonon bath at a given temperature *T*. In particular we study the decoherence in terms of the entanglement formation between the electron, initially described by a Gaussian wavepacket, and the environment by using the quantum entropy called Purity, written in terms of the Wigner function. In our work we evaluate, in a rigorous fully quantum mechanical approach, the electron-phonon interaction using the Wigner-function formalism. The problem is numerically solved for by using Monte Carlo simulations. Results are obtained in a one-dimensional GaAs system but they can be considered indicative of a more general behavior.