

Monte Carlo Investigations of Electron Decoherence due to Phonons

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We investigate alternative Monte Carlo algorithms for simulation of the decoherence of entangled electron states due to scattering by phonons. We begin with a weighted single particle approach which requires an estimator encompassing all time steps to be held in memory. A second algorithm is obtained by synchronously evolving an ensemble of all particles together. While these algorithms are identical from a theoretical point of view, their implementation and run time behaviour differ significantly. A third algorithm exploits the idea of indistinguishable particles, which condenses the information connected to particle location by using phase space cells. An increased number of particles can be considered in this way without exceeding memory constraints. However, an additional source of error arises due to numerical scattering - a consequence of consecutive averaging in the phase space cells. An estimate for the viability of this procedure is provided by a comparison with results obtained from the previous algorithms. Furthermore, the influence of the size of the phase space cells is investigated.