Exciton diffusion in a quantum dot ensemble

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We investigate exciton diffusion in an ensemble of quantum dots (QDs) positioned at a 2-dimensional square lattice put on a circular area. The used model is described in [1]. The Hamiltonian of the system consists of distance-dependent dipole in- teractions and random transition energies drawn from the normal distribution of expected value zero and standard deviation σ which is the significant parameter in the simulation. The central QD is initially excited. The average square of the exciton distance from its ini- tial position in the central QD is calculated as a function of time. Two regimes of diffusion are observed: ballistic motion for the time shorter than $1/\sigma$ and standard diffusion for the time greater than $1/\sigma$ but less than inverse minimal interaction in the system. At later times, saturation is noticed. No difference in diffusion is observed between the system in which all QDs are interacting with each other and the case assuming interactions only with QD at the center. Following [2] a quasi-analytic solution of the Schrödinger equation is performed using Laplace transform which leads to the explanation of the observed effects.

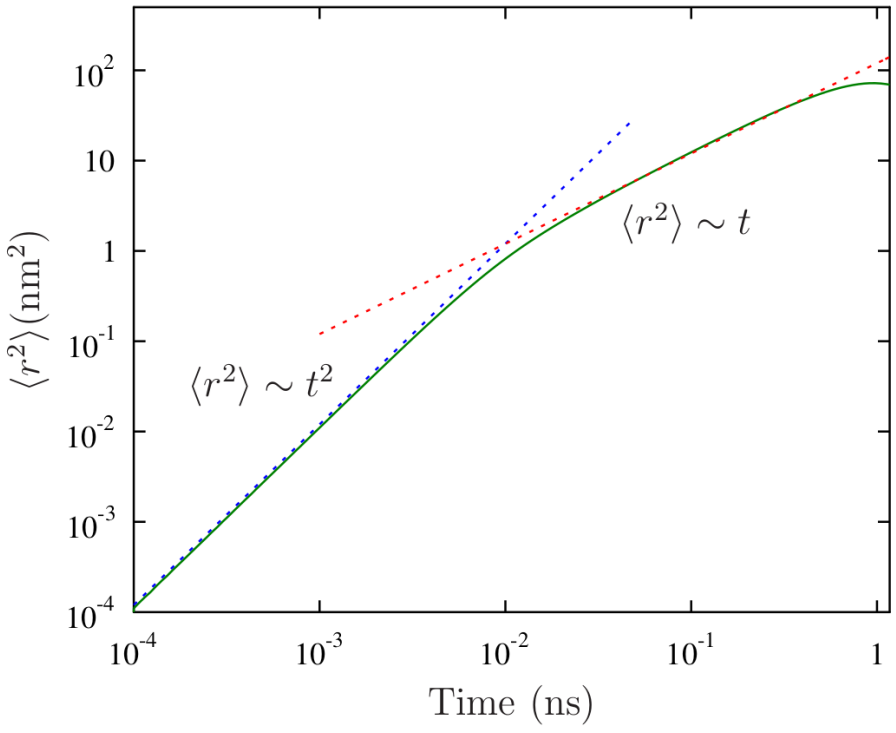

Figure 1: The average squared distance from central QD dependence on time. Initially the ballistic regime is observed then the standard diffusion starts.

[1] F. Miftasani, P. Machnikowski, *Phys. Rev. B* **93**, 075311 (2016).
[2] P. W. Anderson, *Phys. Rev.* **109**, 1492 (1958).