Quantitative theoretical model of single quantum dot blinking

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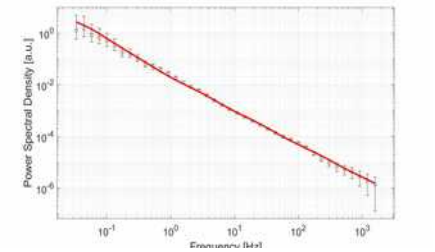
Several decades have passed since the first experimental observation of the single semiconductor quantum dots luminescence blinking. To date, three main mechanisms describing this phenomenon are known in the literature: charging mechanism [1], trapping mechanism [2], hot carriers trapping mechanism. [3]

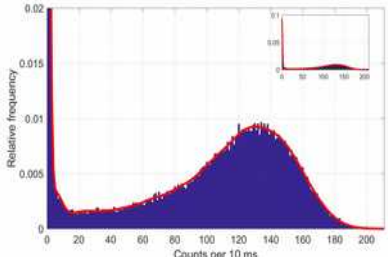
Historically, the first model within the trapping mechanism was proposed by Marcus and Frantsuzov [2]. It is assumed that the quenching of luminescence occurs due to the trapping of one of the carriers, which leads to nonradiative recombination. The trapping rate in the model is related to spectral diffusion and fluctuates with time, resulting in an emission intensity blinking.

A further development of this idea was the multiple recombination centers (MRC) model [4]. A finite number of recombination centers is assumed to exist that can be described by the photoactivated stochastic two-level systems set. Switching of such centers leads to a change in the trapping rate, resulting in a good correspondence between theory and experiment.



Nevertheless, until now, there is no a model that quantitatively describes both the spectral power density (PSD) and the probability density function (PDF) of the blinking intensity.

We present new model, based on trapping mechanism, that can fit quantitatively both the spectral density and probability density function. Without abandoning the basic ideas of MRC model, this model connects fluctuations in luminescence signal with long-term changes in the value of the electron-phonon interaction.



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