Charging dynamics of self-assembled InAs quantum dots in n-GaAs Schottky diodes

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Self-assembled quantum dots (SAQDs) are used in optical devices like infrared light emitting diodes [1] and lasers [2] and have been studied in relation to flash memory cells [3]. It is therefore important to have a large repertoire of methods available for the preparation and diagnostics of SAQD states and their interaction with the environment. We study the charge transfer dynamics between self-assembled InAs quantum dots embedded in n-GaAs Schottky diodes and the space charge region by Laplace deep level transient spectroscopy (LDLTS). Both filling and emission processes are investigated as a function of temperature and the applied bias voltage [4]. We are able to identify electron tunneling and thermally activated processes and quantitatively model the dynamics within the accessible parameter space. We show that the fundamental problems, which originate from the ill-posed character of the inverse Laplace transform, can be solved by a careful choice of the regul arization parameter based on the accurate knowledge of the signal-to-noise ratio.

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