## Nanotechnology and nanomaterials

# Peculiarities of exciton dynamics in hybrid dot-well nanostructures

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Recently various techniques are developed allowing the production of hybrid semiconductor nanostructures for wide optoelectronic applications that include high-performance lasers, quantum information processors, single electron transistors, etc. In these structures, the nano-objects of different dimensionality controllably interact with each other through direct wave-function overlap (at small distances), short-range dipolar interactions or long-range polariton coupling (at large distances). The strength of interaction can be changed varying the distances between nano-objects or the heights of potential barriers separated them.

We present here our results on investigation of tunnel injection structures where the quantum well (QW), acting as the carrier injector, is coupled with quantum dot (QD) layer, acting as the emitter, through the separating barrier. In such structures, the localized, quasi-zero-dimensional (0D), QD states are tunnel-coupled with the two-dimensional (2D) QW states, creating 0D-2D hybrid structures.

By investigating the carrier dynamics using time-resolved spectroscopy and the state filling effects in the continuous-wave excitation regime the basic characteristics of inter-level, inter-sublevel and dot-well relaxation are determined for the InAs QD/ $In_{0.15}Ga_{0.85}As$ QW heterostructures. The mechanisms of the dot-well coupling are discussed. Thermally induced carrier redistribution between QD and QW layers is observed. This redistribution significantly affects the QD and QW PL intensities depending both on the dot-well barrier thickness and height. For comparatively thin barriers the interplay of tunnel and thermal carrier fluxes becomes crucial for determination of exciton dynamics in a tunnel injection dot-well structure at higher temperatures. The role of in-well exciton localization and the strain-induced localized states in the QD layer is clarified.