

## Light hole excitonic states in CdTe/ZnTe QDs

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We show that in the photoluminescence of CdTe/ZnTe quantum dots (QDs) one can observe not only the standard emission lines associated with heavy-hole (hh) excitons, but also the lines of symmetry corresponding to light-hole (lh) excitons, as recently reported also for GaAs QDs [1]. In our case, lh and hh lines are grouped in two partially overlapping emission bands. In each band typical lines of CdTe/ZnTe QDs were resolved and exciton, trion, and biexciton lines were identified using single-photon correlation measurements.

Two types of consistent experiments are presented. The analysis of the Zeeman effect for exciton lines for two configurations of magnetic field, and polarization resolved measurements of three-dimensional anisotropy of quantum dots.

The Zeeman splitting of emission lines from the same QD in two configurations of magnetic field were studied with the use of a cryostat with vector-rotate magnet. The emission lines from the low energy band showed high values of g factors for  $B\parallel z$  and small for  $B\perp z$ , which is typical for hh excitons. While the lines associated with the high energy band showed a small g factors for  $B\parallel z$  and large for  $B\perp z$ . This result points out that the emission lines observed in high energy band are associated with lh states.

Light hole states are composed of a wave function of XYZ symmetry, pure hh states contain only wave function with XY symmetry. Therefore as the second method we used polarization study of photoluminescence emitted from the edge of the sample – the measurements in configuration in which the optical axis is perpendicular to the growth axis of the sample ( $k\perp z$ ). Thus the emission with both polarizations: perpendicular and parallel to the growth axis could be detected. It was found that the great majority of quantum dots from low energy band show complete polarization perpendicular to the axis of growth, as expected for the hh excitons. The high energy band showed for bright exciton, trion, and biexciton lines a low degree of linear polarization with domination of polarization parallel to the growth axis of the sample (Z). It is characteristic for lh states. Close to the typical bright exciton line we observe also emission line completely polarized along Z axis which appears due to the light hole excitons or they strong admixture to the hh dark excitonic state. Such Z-polarized lines, but with weaker intensity, are also observed for low energy band, as we already reported [2].

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[2] T. Smoleński, T. Kazimierczuk, M. Goryca, T. Jakubczyk, Ł. Kłopotowski, Ł. Cywiński, P. Wojnar, A. Golnik, and P. Kossacki, *Phys. Rev. B* **86**, 241305(R) (2012)