MULTI-CARRIERS COMPLEXES IN SINGLE CdTe/ZnTe QUANTUM DOTS

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In quantum dots (QDs) systems the carrier-carrier interaction is enhanced by strong overlap of their wavefunctions. Lack of inhomogeneous broadening gives a unique possibility to observe interactions of order of 100μeV. Excitonic lines of single QDs exhibit fine structure with polarization anisotropy, that originates from anisotropic electron-hole exchange (AES) interaction. It is know that charged excitons have no exchange splitting (δ_{ex})[1] while δ_{ex} for exciton and biexciton transitions has the same value but opposite sign[2].

We present results of polarization-resolved micro-photoluminescence (μPL) experiments on self-organized CdTe/ZnTe quantum dot (QD) system grown by MBE on (001) GaAs substrate. All measurements were performed at low temperatures (in superfluid He) and in magnetic field. We used multi-line UV Ar^+ laser for excitation. Individual QD lines were observed in the spectra.

For spatial identification of the lines we used the effect of sudden jumps of the line position[3]. For three of the lines (A, B, and C) the jumps occurred simultaneously (see figure 1). It means that these lines originate probably from the same QD. The effect of jumping decreases and even disappears at small excitation power. The relative energy positions of the lines suggest their identification as neutral and charged exciton (A and B), and biexciton (C). The excitation power dependence (intensity of line C grows much faster with the excitation power than that of lines A and B, as expected for a biexciton[4]) confirms our assumption. The strongest argument for the identification of A, B, and C lines comes from polarization measurements. As expected for a trion, line B exhibits no splitting while lines A and C are doublets (see Fig. 1) containing two linearly polarized components split by AES. The splitting for A and C lines has the same value and opposite sign. An additional verification of our hypothesis is Zeeman effect measurements giving approximately equal values of effective Lande factor for lines A, B and C.

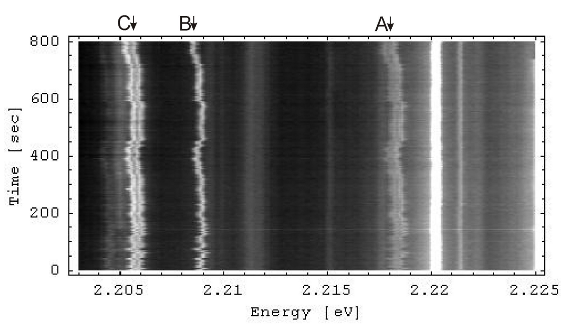

Fig. 1. Temporal evolution of mmicrophotoluminescence spectrum (excitation beam power $P_0 \approx 540\mu W$ in front of cryostat). Lines A, B, and C correspond to exciton, charged exciton, and biexciton, respectively.

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