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Electronic excitation energy transfer in arrays of CdS quantum dot on the spherical surface

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The optical spectra of films based on silica spheres with a radius R ~ 150 nm coated with small-radius CdS quantum dots (R_0 ~ 1.76nm) were obtained and analyzed. Large shifts in the absorption and photoluminescence bands as a function of the concentration of quantum dots, the density, and the pump wavelength were detected. An analysis of the experimental data has shown that this is due to the transfer of the electron excitation energy by quasiparticles according to the tunneling mechanism, which is due to the strong electronic coupling between them. We observed up to an ~ 100 meV change in coupling energy in both the absorption and photoluminescence spectra of CdS QDs films**.** The observations can be qualitatively explained by a hybridization of the band edge orbitals, $1S_e$ and $1S_h$ of CdS QDs due to a strong electronic (tunneling) coupling between neighboring CdS QDs [1]. The resulting reduction of the confinement energy due to electron (and hole) delocalization explains the red-shift and broadening of the absorption spectra of CdS QDs [2]. Using small intensities and different pump wavelengths, we obtained results that allowed us to reconstruct the distribution function of quantum dots CdS in size, which is well approximated by the Gaussian function.

1. *K. N. Lawrence, M.l A. Johnson, S. Dolai, A. Kumbhar, R. Sardar* Solvent-like ligand-coated ultrasmall cadmium selenide nanocrystals: Strong electronic coupling in a self-organized assembly // Nanoscale ,-2015.**-7.-**P. 11667-11675.

2. *R. Koole, P. Liljeroth, C. de Mello Donega, D. Vanmaekelbergh, A. Meijerink.* Electronic Coupling and Exciton Energy Transfer in CdTe Quantum-Dot Molecules // JACS.-2006.**-128**, - P. 10436 - 10446.