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Giant Efficiency of Fröhlich Interaction in Self-Assembled Quantum Dots

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Abstract: A transition is being observed from an inhomogeneously broadened photoluminescence band under non-resonant excitation of InAs/GaAs Self-Assembled quantum Dots (SAD's) into up to five phonon-assisted emission bands under selective excitation. A similar effect is obtained from photoluminescence excitation experiments (PLE). We interpret the phonon-assisted PL as being due to a giant efficiency of the Fröhlich interaction between an exciton polarized by strain in the SAD and LO-phonons. The model is consistent with the pronounced p-type polarization of the emission observed in our cleaved-side PL-measurements. Further support is obtained from our calculations in which a different localization of the electrons and holes is assumed: The limiting case of this theoretical framework gives a Huang-Rhys factor of ~ 0.1 , which is the same order of magnitude as the experimental value.

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