Multi-Exciton Generation (MEG) in Quantum Dots

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Multi-exciton generation (MEG) is a process in which several electron-hole pairs (excitons) are created upon the absorption of a single photon in semiconductors. MEG would be of great importance for improving the efficiency in next generation solar cells. While it has been suggested that quantum confinement effects may facilitate MEG in semiconductor quantum dots, there has been considerable controversy over the efficiency of MEG in quantum dots as compared to the bulk material. Within the first order perturbation theory, we use an atomistic semiempirical pseudopotential approach to examine several key parameters in the carrier multiplication process and calculate the MEG rates in CdSe quantum dots of various sizes. We show that the MEG rate increases as the dot size decreases for a photon energy scaled to the optical gap of the dot, whereas the opposite trend is found if one considers absolute photon energy to compare the rates of the dots.