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3D engineering of potential profile by charged quantum dots for effective photovoltaic conversion[1] ANDREI SERGEEV, NIZAMI VAGIDOV, VLADIMIR MITIN, University at Buffalo, KIMBERLY SABLON, U.S.Army Research Laboratory, Adelphi — Charging of quantum dots (QDs) is an effective tool for managing of potential profile at micro- and nanoscales. Without radiation, QDs are charged as electrons from the dopants fill QDs. Filling of QDs under solar radiation is determined by the condition of equality of electron and hole capture rates. Because of strong difference in effective masses of electrons and holes, an electron level spacing in QDs substantially exceeds a level spacing for holes. Therefore, QDs play a role of deep traps for electrons, but they are just shallow traps for holes. The holes trapped in QDs may be excited by thermal phonons, while excitation of localized electrons requires IR radiation. Therefore, n-doping of QD structures is strongly preferable for photovoltaic applications. Optimized selective n-doping of QD medium provides micro- and nanoscale potential profiles favorable for effective photovoltaic conversion.

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