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Intermediate Band Performance of GaSb Type-II Quantum Dots Located in n-Doped Region of GaAs Solar Cells ARA KECHIANTZ, ANDREI AFANASEV, George Washington University — The intermediate band (IB) electronic states assist sub-bandgap photons in generation of additional photocurrent in single-junction solar cells. Such non-linear effect of resonant two-photon absorption of concentrated sunlight attracts much attention because it promises up to 63% conversion efficiency in IB solar cells. The main obstacle to achieving high performance is involvement of IB-states in electron-hole recombination that is drastically increasing the dark current and reducing the open circuit voltage of IB solar cells. The IB-states can be composed of quantum dots (QDs). Concentration of sunlight limits recombination through type-II QD IB-states located outside of the depletion region. In this work we model GaAs solar cell with strained GaSb type-II QDs separated from the depletion region. The focus is on type-II QDs located in n-doped region of p-n-junction. Our calculation shows that photovoltaic performance can be essentially improved by concentration of sunlight, and that this improvement is highly sensitive to the doping of materials and the shape of potential barriers surrounding type-II QDs. For instance, strained GaSb type-II QDs may increase the performance of GaAs solar cell by 20% compared to the reference GaAs solar cell without QDs.

Andrei Afanasev
George Washington University

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