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Colloidal Nanoparticles for Intermediate Band Solar Cells[1] MARTON VOROS, GIULIA GALLI, Institute for Molecular Engineering, University of Chicago, GERGELY ZIMANYI, Department of Physics, University of California, Davis — The Intermediate Band (IB) solar cell concept is a promising idea to transcend the Shockley-Queisser limit.[1] Using the results of first principles calculations, we proposed that colloidal nanoparticles (CNPs) are a viable and efficient platform for the implementation of the IB solar cell concept. We focused on CdSe and we showed that intragap states present in the isolated dots with reconstructed surfaces combine to form an IB in arrays of NPs, which is well separated from the valence and conduction band edges. We also showed that in solution such IB may be electron doped using, e.g. decamethylcobaltocene, thus activating an IB-induced absorption process. Our results, together with the recent report of a nearly 9% efficient CNP solar cell[2] indicate that colloidal nanoparticle intermediate band solar cells are a promising platform to overcome the Shockley-Queisser limit.
[1] Antonio Luque and Antonio Martí, Phys. Rev. Lett. 78, 5014 (1997). [2] Chia-Hao M. Chuang et al., Nature Materials 13, 796 (2014).

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