Abstract Submitted
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Multiple Exciton Generation in Colloidal Si Nanocrystals at the Energy-Conservation-Limit[1] M. SAGAR DODDERI, NREL, JIHUA YANG, UWE KORTSHAGEN, University of Minnesota, ERIN WHITNEY, OCTAVI SEMONIN, NREL, ARTHUR NOZIK, CU-Boulder, MATHEW C. BEARD, NREL, M.C. BEARD TEAM, UWE KORTSHAGEN COLLABORATION — Silicon covers more than 90% of photovoltaic cell production and is the 2[nd] most Earth-abundant element. In a Bulk Silicon solar cell about half of the total absorbed energy is lost as heat, following the detailed balance Shockley-Queisser (SQ) analysis. Generating multiple excitons (MEG) in quantum confined Nanocrystals per absorbed high energy photon is a route to circumvent some of the heat losses and thereby enhance photoconversion efficiency. However, to utilize the absorbed excess energy for MEG and to break the SQ limit it is desirable to establish MEG threshold as close as possible to 2 x E_g. Using femtosecond transient absorption spectroscopy, we demonstrate for the first time the generation of multiple excitons *right at the energy-conservation-limit (2 x* E_g*)* in colloidal Si nanocrystals. The observed 'near hard MEG-onset' is independent of the size of the nanocrystals studied (2.8 nm and 3.5 nm dots). Unlike Lead chalcogenides, the effect of photocharging on MEG yield is not observed in Si nanocrystals even at moderate pump-photon fluences ($\sim$ 10 nJ), much higher than the fluence typically used to measure MEG (< 1nJ). The efficient MEG and the observation of 'near hard MEG-onset' at 2 x E_g in an indirect band gap semiconductor is extremely promising and has strong implications for third generation photovoltaics and is expected to enhance photoconversion efficiencies.

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