Multiple Exciton Generation in Lead Selenide Nanorod Solar Cells with External Quantum Efficiencies Exceeding 120%

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Multiple excitation generation – a process in which multiple charge-carrier pairs are generated from a single optical excitation - is a promising way to improve the photocurrent in photovoltaic devices and offers the potential to break the Shockley-Queisser limit. One-dimensional nanostructures, e.g. nanorods have been shown spectroscopically to display increased MEG efficiencies compared to their zero-dimensional analogues. Here we present solar cells fabricated from PbSe nanorods of three different bandgaps. All three devices showed external quantum efficiencies (EQEs) exceeding 100 % and we report a maximum EQE of 122% for cells consisting of the smallest bandgap NRs. We estimate internal quantum efficiencies to exceed 150% at relatively low energies compared with other MEG systems, and this demonstrates the potential for substantial improvements in device performance due to MEG.

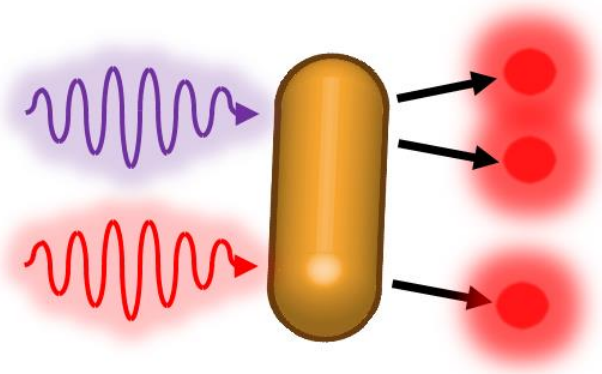

Fig. 1 Multiple exciton generation in Lead selenide nanorods.