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**The Effect of Photoexcitation and Population Relaxation on Carrier Multiplication Efficiency in Semiconductor Nanocrystals and Bulk**
ANDREI PIRYATINSKI, KIRILL VELIZHANIN, Los Alamos National Laboratory — The carrier multiplication (CM) is the process of production of two or more electron-hole pairs (excitons) per single absorbed photon. Detailed understanding of the mechanisms of this process is of importance for developing novel cheap and efficient photovoltaic devices. To model the CM dynamics, we have developed an exciton scattering model which accurately treats the contributions of different multi-exciton generation pathways on the same footing. Furthermore, the model allows one to study CM in nanocrystalline and bulk semiconductor materials. Using this model, we performed a numerical study of photogeneration and population relaxation processes contributing to CM in PbSe nanocrystals and bulk. It is found that the photogeneration provides small contribution to the total quantum efficiency compared to the population relaxation process. The resonant incoherent biexciton production is found to be main mechanism of CM in both cases of direct biexciton photogeneration and during the population relaxation. Comparison to the published experimental data shows that the calculations reproduce experimentally observed trends providing insight into the mechanisms of CM.

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