Abstract Submitted
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Effect of Photoexcitation and Population Relaxation on Carrier Multiplication Efficiency in Semiconductor Nanocrystals KIRILL VELIZHANIN, ANDREI PIRYATINSKI, Theoretical Division, LANL, VICTOR KLIMOV, Chemistry Division and CINT, LANL — The carrier multiplication (CM) is the process of production of more than one electron-hole pair (exciton) per single photon absorbed. It has important implications in developing new photovoltaic devices. To theoretically describe such processes we have developed an exciton scattering model which treats contributions of different biexciton photogeneration channels and the population relaxation to the CM efficiency on equal footing [1]. Furthermore, the model allows one to study CM processes in both bulk and nanocrystalline semiconductor materials. The model is applied to study CM efficiency in bulk and nanocrystals of PbSe. The model parameters, i.e., single- and bi-exciton energies and wavefunctions as well as transition dipoles and Coulomb scattering amplitudes, are obtained within the effective mass envelope function formalism. Analysis of interfering bi-exciton photogeneration channels, effect of population relaxation, and the comparison with experiment will be provided. [1] A. Piryatinsky and K. A. Velizhanin, arXiv:0911.1139v

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