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Scaling of Multiexciton Nonradiative and Radiative Decay Rates with Exciton Number in Semiconductor Nanocrystals[1] JOHN A. MCGUIRE, VICTOR I. KLIMOV, Chemistry Division, Los Alamos National Laboratory — Rapid multiexciton decay by nonradiative Auger recombination places strong constraints on potential applications of semiconductor nanocrystals (NCs) in lasing and solar energy conversion exploiting carrier multiplication. Hence, it is important to understand the scaling of the Auger recombination rate with exciton number in NCs. Likewise, understanding the scaling of multiexciton radiative rates with exciton number is important both for potential applications of, e.g., ordered multiphoton emission and for interpreting experimental measurements of time-resolved photoluminescence. We report measurements of the scaling of Auger and recombination rates in CdSe and PbSe NCs and of multiexciton radiative rates in PbSe NCs. The more rapid scaling of Auger rates with exciton number N in PbSe compared to CdSe can be understood in terms of the different symmetries of N-excitons with N>2 due to the different degeneracies of the lowest-energy excitonic states. The scaling of the multiexciton radiative rates in PbSe can be interpreted in terms of a "free-carrier" model.

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