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Excited states dynamics of Er^{3+} pairs in CsCdBr_3

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CsCdBr_3 is a very convenient host to study pair dynamics because trivalent impurities enter it nearly only as charge compensated dimers. This peculiar structure also enhances energy transfers involving two ions and especially APTE processes.

We have studied Er^{3+} anti-Stokes violet and UV emissions under various visible excitations which involved several mechanisms.

First, excitation in the $^4\text{S}_{3/2}$, $^4\text{F}_{7/2}$ or $^4\text{F}_{5/2}$ levels results in efficient anti-Stokes emissions between 25300 and 32600 cm^{-1} . Up-conversion is due to an energy transfer in symmetric pairs (Er^{3+} -Vacancy- Er^{3+}) which are the dominant center in this compound. However, $^4\text{G}_{9/2}$ and $^4\text{G}_{11/2}$ fluorescence decays can not be explained by simple relaxation schemes.

Then, in order to determine the mechanisms of up-conversion under these different excitations, transients of $^4\text{D}_{5/2}$ and $^4\text{G}_{9/2}$ levels, which are difficult to reach directly, have been studied using Excited State Absorption in the $^4\text{F}_{9/2}$ state. Detailed excitation spectra have also been recorded for these high energy levels and energies of these multiplets have been precisely established.

Finally, these results enabled us to model the fluorescence transients obtained under single color excitation. This analysis is based on competing relaxations in erbium dimers which are very efficient in this system.