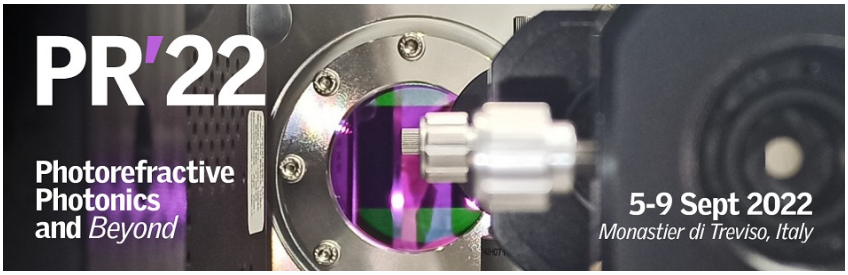

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The impact of self-trapped excitons for the photophysics of lithium niobate

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Various manifestations of small polarons strongly affect the linear and nonlinear optical properties of the oxide crystal lithium niobate (LiNbO3, LN). While related transient absorption phenomena in LN have been extensively studied in recent decades, a sound microscopic picture describing the blue-green (photo)luminescence of lithium niobate single crystals is still missing. In particular, almost nothing is known about: (i) the luminescence build-up and (ii) its room temperature decay.
We present here the results of our systematic experimental study using nominally undoped and Mg-doped LN crystals with different Mg concentration. Picosecond luminescence was detected by means of femtosecond fluorescence upconversion spectroscopy (FLUPS) extended to the inspection of oxide crystals in reflection geometry. Two distinct luminescence decay components on the picosecond time scale are revealed. While a short exponential decay is present in each sample, a longer non-exponential decay clearly depends on the crystal composition. Since transient absorption spectroscopy excludes geminate small polaron annihilation as microscopic cause of the luminescence, both decay components are discussed in the context of self-trapped exciton (STE) transport and decay.

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