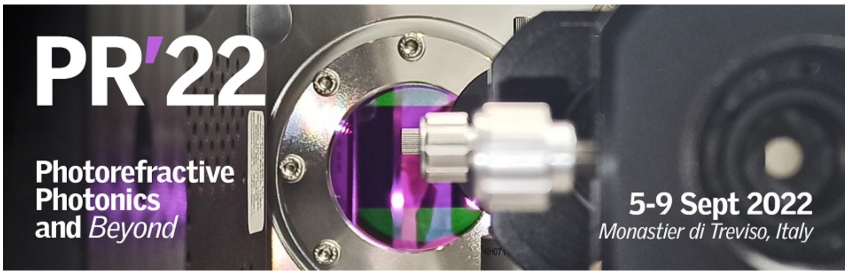

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Electronic balls and photonic clubs in photogalvanic lithium niobate: a first principles approach

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The photogalvanic effect (PGE) consists in the spontaneous production of a bulk electrical current density in a polar material when the latter is illuminated [1]. This effect triggers several phenomena which are at the basis of important applications such as photorefraction, photovoltaic energy conversion in photoferroelectrics, photocatalysis and so on [2,3,4].
Despite the fact that a microscopic understanding of the PGE is nowadays quite achieved, it still relies on a few phenomenological parameters. In particular the thermalization length, describing the absolute average distance from the emitting site at which a photo-excited charge self-localizes into a polaron, cannot be obtained from experiments and at the same time it is the critical parameter ruling the photogalvanic properties of a given material.
In this work we present a mean-field approach [5] to describe the energy loss of the photoemitted charge interacting with the phonon bath of the material, which allows us to compute the thermalization length. Our results are applied to the technologically important case of lithium niobate [6]. Using our method we can reproduce the wavelength dependence of the PGE and compare the obtained results with experimental data [7].

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