Ultrafast charging in a two-photon Dicke quantum battery

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We consider a collection of two level systems embedded into a microwave cavity as a promising candidate for the realization of high power quantum batteries. In this perspective, the possibility to design devices where the conventional single-photon coupling is suppressed and the dominant interaction is mediated by two-photon processes is investigated, opening the way to an even further enhancement of the charging performance [1]. By solving a Dicke model with both single and two-photon coupling we determine the range of parameters where the latter unconventional interaction dominates the dynamics of the system leading to better performances both in the charging times and average charging power of the QB compared to the single-photon case. In addition, it is found that the scaling of the charging power with the finite number of qubits N shows a quadratic growth leading to a relevant improvement of the charging performance of quantum batteries based on this scheme with respect to the purely single-photon coupling case [1].

[1] A. Crescente, M. Carrega, M. Sassetti, D. Ferraro, Ultrafast charging in a two-photon Dicke quantum battery, Phys. Rev. B 102, 245407 (2020).