The power of photons: Cavity-mediated energy transfer between quantum devices

Alba Crescente

Dipartimento di Fisica, Università di Genova, Via Dodecaneso 33, 16146, Genova, Italy.
CNR-SPIN, Via Dodecaneso 33, 16146, Genova, Italy.

crescente@fisica.unige.it

Abstract

We investigate the coherent energy transfer between two quantum systems mediated by a quantum bus. In particular, we consider the energy transfer process between two qubits, and how it can be influenced by using a resonant cavity as a mediator. Inspecting different figures of merit and considering both on and off-resonance configurations, we characterize the energy transfer performances. We show that the cavity-mediated process is progressively more and more efficient as function of the number of photons stored in the cavity that acts as a quantum bus [1]. The speeding-up of the energy transfer time, due to a quantum mediator paves the way for new architecture designs in quantum technologies and energy based quantum logics [2].

References

[1] A. Crescente, D. Ferraro, M. Carrega, M. Sassetti, Phys. Rev. Research, 4 (2022) 033216.
[2] P. Scarlino, D. J. van Woerkom, U. C. Mendes, J. V. Koski, A. J. Landig, C. K. Andersen, S. Gasparinetti, C. Reichl, W. Wegscheider, K. Ensslin, T. Ihn, A. Blais, A. Wallraff, Nature Comm. 10 (2019) 3011.

Figures

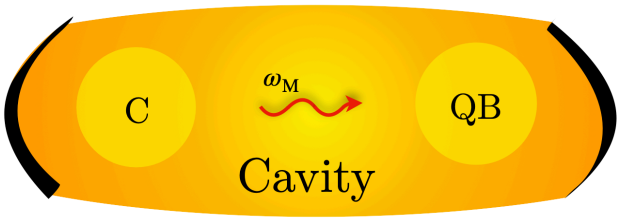

Figure 1: Schematic setup for a cavity-mediated energy transfer between a charger (C) and a quantum battery (QB).

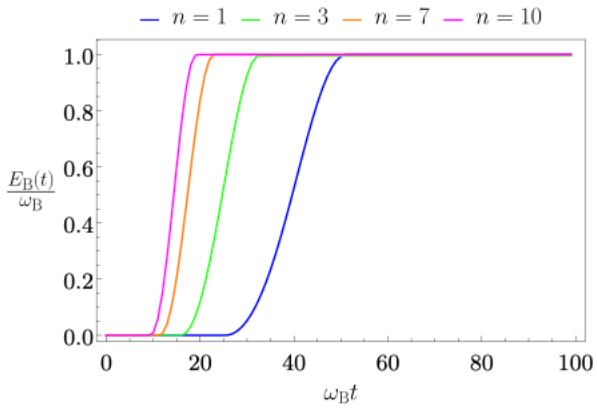

Figure 2: Speeding up in the energy transfer process $E_B(t)$ increasing the number of photons n.