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# Designing reservoirs for 1/t decoherence process in Jaynes-Cummings model

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<p>Decoherence indicates the process that a quantum system undergoes through the interaction with an external environment. The central issue and one of the greatest challenges in Nanotechnology and Quantum Information Processing is the way to control or delay the destructive effect of the environment on qubit coherence. For this reason, a qubit interacting with a reservoir of bosons (external environment), described by a Jaynes-Cummings model, is considered. The decoherence process corresponding to Lorentzian type distributions of field modes results in exponential like relaxations. At this stage we adopt the engineering reservoir approach as the way of delaying the decoherence process. A special class of reservoirs of field modes is designed in order to obtain a decoherence process resulting, over estimated long time scales, in inverse power laws with powers decreasing continuously to unity according to the choice of the particular reservoir. The designed reservoirs exhibit a photonic band gap coinciding with the qubit transition frequency and are piecewise similar to those usually adopted in Quantum Optics, i.e., sub-ohmic at low frequencies and inverse power laws at high frequencies. Initially, the reservoir is assumed to be in the vacuum state and is unentangled from the qubit versing in a generic state. The exact dynamics results to be described by series of Fox $H$-functions. The simple form of the designed reservoir can be accessible experimentally.

## Level (Hons, MSc, <br>   PhD, other)?

NITheP PostDoc

## Consider for a student <br>   award (Yes / No)?

No

## Would you like to <br> submit a short paper <br> for the Conference <br> Proceedings (Yes / No)?

Yes

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