# Review of: "Correlated noise enhances coherence and fidelity in coupled qubits"

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Potential competing interests: No potential competing interests to declare.

Manuscript considers a pair of quibits subject to local environmenrts and discusses role of noise correlation in the baths on enhancement of fidelity and purity of Bell state. Authors strt their consideration from writing dowan a stochastic Wiener process with correlation matrix **$\Sigma$**, and derive the Bloch-Redfield quantum master equation QME) with the correlation entering its dissipator. Then they employ secular approximation which leads to Lindblad form of the Refiled QME in which dynamics of populations and coherences is decoupled. It is shown  that one can engineer the noise correlation is such a way that it enhances coherence in the system. Authors claim that the observation may be useful in design of quantum communication protocols. The study is interesting and its connection to quantum information makes it also very timely.

The main effect, bath induced coherence, has been discussed also in previous works. Moreover, separation between intra-system (usual) and bath-induced (correlated noise) coherences does not seem to be fundamental. Formally, bath induced coherence is given by off-diagonal elements of dissipation matrix. Diagonalizing the latter (basis rotation) in any basis-independent consideration (e.g. in Green's function descriptoion of the system) transfers bath-induced to intra-system coherences. However, (as far as I know) this manuscript is the first time when the concept is applied to quantum communication problems.

Technical consideration (implementation of the Redfield/Lindblad QME) is the only part which may be questionable. That is, low (second order) QME is known to be highly unreliable in predicting bath-induced coherences. For example, inadequacy of the second order QME in prediction of the coherences was discussed in Ref. [1] and illustrated in Refs. [2,3]

**References**

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[3] Y. Gao and M. Galperin, J. Chem. Phys. **144**, 244106 (2016).