Exact reduced density matrix of a Resistively Shunted Josephson junction

Philippe Joyez*[1]

[1]Service de Physique de l'Etat Condensé (SPEC UMR 3680 CEA-CNRS UPSAY) – CEA, CNRS : UMR3680 – SPEC, CEA Saclay, Orme des Merisiers, 91191 Gif-sur-Yvette, France, France

Résumé

I will show that the reduced density matrix of a resistively shunted Josephson junction (RSJ) can be obtained using the stochastic Liouville equation method in imaginary time – an exact numerical scheme based on the Feynman-Vernon influence functional. In this approach, the resistance-induced modifications of the junction's equilibrium state are expected to be perturbative in the large R limit. Indeed, in this limit, numerical results recover the results of the well-known Cooper pair box (CPB) family of qbits. For all parameters looked at, the shunted junction is found more superconducting than in the unshunted CPB, with no trace of the dissipative quantum phase transition long believed to occur in the RSJ. This work brings a theoretical confirmation to a similar conclusion previously drawn by Murani et al., based on experimental observations. It also explains precisely how the phase of a Josephson junction decompactifies in presence of an environment.

*Intervenant