



Contribution ID: 16

Type: Talk

Spectroscopic characterization of the Markov to non-Markov transition in qubit-impurity systems

Tuesday, 7 May 2024 17:00 (30 minutes)

The behavior of many dissipative systems is generally described by a non-Markovian dynamics. Memory effects associated to non-Markovianity may lead to revival of coherence and entanglement and may be exploited as resources for quantum computation [1,2]. In this work, we study a toy model system of a qubit coupled to an incoherent impurity [3-5] which has been shown to exhibit a transition from a Markovian regime to a non-Markovian dynamics [6,7], depending on tunable parameters of the system. We investigate this behavior by quantifying the non-Markovianity [8] and by studying the frequency spectrum of the qubit coherence [9]. We study the phase diagram in several regimes and show that the transition is tuned by the qubit-impurity interaction strength and by the temperature of the impurity. Our work aims at introducing spectroscopic witnesses that are easy to measure and are able to quantify the non-Markovianity of a system.

[1] M. Tsitsishvili, D. Poletti, M. Dalmonte, and G. Chiriacò, “Measurement induced transitions in non-markovian free fermion ladders,”(2023), arXiv:2307.06624 [quant-ph].

[2] D. Gribben, J. Marino, and S. P. Kelly, “Markovian to non-markovian phase transition in the operator dynamics of a mobile impurity,”(2024), arXiv:2401.17066 [quant-ph].

[3] E. Paladino, L. Faoro, G. Falci, and R. Fazio, Phys. Rev. Lett. 88, 228304 (2002);

[4] E. Paladino, L. Faoro, A. D’Arrigo, and G. Falci, Physica E: Low-dimensional Systems and Nanostructures 18, 29–30 (2003).

[5] Paladino, E., Faoro, L., Falci, G. Advances in Solid State Physics, 43 747 (2003)

[6] E. Paladino, M. Sassetti, G. Falci, and U. Weiss, Phys. Rev. B 77, 041303 (2008).

[7] E. Paladino, Y. M. Galperin, G. Falci, and B. L. Altshuler, Rev. Mod. Phys. 86, 361 (2014).

[8] H.P. Breuer, E. Laine and J. Piilo, Phys. Rev. Lett. 103, 210401 (2009)

[9] C. Benedetti, M. G. A. Paris, and S. Maniscalco, Phys. Rev. A 89, 012114 (2014).

Abstract category

Quantum Optics

Primary author: CHIATTO, Giuseppe Emanuele (Università degli Studi di Catania)

Co-authors: PALADINO, Elisabetta (University of Catania, INFN Sez. Catania, CNR-IMM Catania); Dr CHIRIACÒ, Giuliano (University of Catania); FALCI, Giuseppe (University of Catania, INFN Sez. Catania, CNR-IMM Catania)

Presenter: CHIATTO, Giuseppe Emanuele (Università degli Studi di Catania)

Session Classification: Talks