

## Tackling with non-Markovianity

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Historically, Markovian quantum time evolutions were associated to the Kossakowski-Lindblad form of master equations and, as a consequence, all of the quantum dynamical equations which could not be recast in the Kossakowski-Lindblad form were called non-Markovian. However, the existence of time-dependent Kossakowski-Lindblad forms has lately attracted the attention of several groups asking for a broad definition of Markovianity and quantifying deviations from it. Actually the very definition of a non-Markovian process has very recently given rise to a vivid debate in the scientific community [1-4].

Here we present a summary of the different concepts non-Markovianity and show a way to unify them. Thus, we propose a unique solution for the problem of how to define Markovianity. This takes the advantage of previous ideas and approaches leading to a well-defined mathematical property which, in addition, enjoys an operational meaning.

Furthermore, we review some of the recently proposed measures of non-Markovianity explaining their meaning and how to compute them.

<sup>1</sup> M. M. Wolf, J. Eisert, T. S. Cubitt and J. I. Cirac, *Phys. Rev. Lett.* **101**, 150402 (2008).

<sup>2</sup> H.-P. Breuer, E.-M. Laine and J. Piilo, *Phys. Rev. Lett.* **103**, 210401 (2009).

<sup>3</sup> Á. Rivas, S. Huelga and M. B. Plenio, *Phys. Rev. Lett.* **105**, 050403 (2010).

<sup>4</sup> D. Chruściński, A. Kossakowski and A. Rivas, *Phys. Rev. A* **83**, 052128 (2011).