

# Sudden death and rebirth of entanglement of the Werner state obtained by using time-dependent magnetic fields

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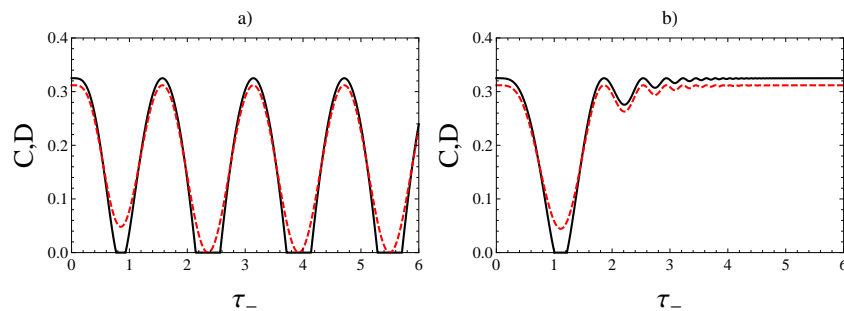
## Abstract

We show that sudden death, followed by rebirth of entanglement can occur in the evolved Werner state under the influence of some specific time-dependent magnetic fields. A comparison between the concurrence and quantum discord for the evolved Werner state is presented in detail.

We consider a two-spin-1/2 system subjected to local controllable time dependent magnetic fields. For some specific expressions of the magnetic fields acting upon the two spins, the Schrödinger equation has been exactly solved by decoupling into two independent problems of a single spin-1/2 particle [1].

We assume that the initial state of the two-spin-1/2 system is the Werner state  $\rho_W = \frac{1-\alpha}{4} I \otimes I + \alpha |\Psi^-\rangle\langle\Psi^-|$ , where  $|\Psi^-\rangle = \frac{1}{\sqrt{2}}(|01\rangle - |10\rangle)$  is the singlet state and  $\alpha \in [-\frac{1}{3}, 1]$ .

We evaluate the Concurrence (C) and, by using the method from Ref. [2], the quantum Discord (D), making a comparison between them, in case of two exactly solvable scenarios. We find sudden death and rebirth of entanglement: in the figures below Discord and Concurrence are plotted in red and black, respectively. Entanglement sudden death represents the decrease of the entanglement to zero in a short time [3]. A lot of attention has been devoted in recent years to the study of a combined process, which consists of sudden death, followed by the rebirth of entanglement, e.g. in the case of two qubits interacting with a common structured reservoir [4].



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