Quantum Inf Process (2009) 8:535–548
DOI 10.1007/s11128-009-0144-7

Entanglement dynamics during decoherence

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Received: 16 July 2009 / Accepted: 30 August 2009 / Published online: 10 October 2009

Abstract The evolution of the entanglement between oscillators that interact with the same environment displays highly non-trivial behavior in the long time regime. When the oscillators only interact through the environment, three dynamical phases were identified (Paz and Roncaglia in Phys Rev Lett 100:220401, 2008) and a simple phase diagram characterizing them was presented. Here we generalize those results to the cases where the oscillators are directly coupled and we show how a degree of mixidness can affect the final entanglement. In both cases, entanglement dynamics is fully characterized by three phases (SD: sudden death, NSD: no-sudden death and SDR: sudden death and revivals) which cover a phase diagram that is a simple variant of the previously introduced one. We present results when the oscillators are coupled to the environment through their position and also for the case where the coupling is symmetric in position and momentum (as obtained in the RWA). As a bonus, in the last case we present a very simple derivation of an exact master equation valid for arbitrary temperatures of the environment.

Keywords Entanglement · Decoherence · Quantum Brownian Motion

PACS 03.67.Bg · 03.65.Yz · 03.67.Mn · 05.40.Jc

1 Introduction

In recent years it became clear that the study of the evolution of entanglement for open quantum systems is an important issue not only for fundamental reasons but

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