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Oxide double quantum dot - an answer to the qubit problem?
SUDHAKAR YARLAGADDA[1], AMIT DEY, Saha Institute of Nuclear Physics, Kolkata — We propose that oxide-based double quantum dots with only one electron (tunnelling between the dots) can be regarded as a qubit with little decoherence; these dots can possibly meet future challenges of miniaturization. The tunnelling of the e_g electron between the dots and the attraction between the electron and the hole on adjacent dots can be modelled as an anisotropic Heisenberg interaction between two spins with the total z-component of the spins being zero. We study two anisotropically interacting spins coupled to optical phonons; we restrict our analysis to the regime of strong coupling to the environment, to the antiadiabatic region, and to the subspace with zero value for S_{zT} (the z-component of the total spin). In the case where each spin is coupled to a different phonon bath, we assume that the system and the environment are initially uncorrelated (and form a simply separable state) in the polaronic frame of reference. By analyzing the polaron dynamics through a non-Markovian quantum master equation, we find that the system manifests a small amount of decoherence that decreases both with increasing nonadiabaticity and with enhancing strength of coupling g.

[1]Recently I got an invitation to visit Argonne National Lab from Jan./2106 to end of March/2016. I thought I would give a talk at APS March meeting. Please accept the submission.

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