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Single spin decoherence by general spin chains CHENG-YAN LAI, POCHUNG CHEN, National Tsing Hua University — Spin decoherence induced by a spin bath has recently been the subject of interest in the field of quantum computation and spintronics. Unlike the spin-boson model, the resulting decoherence depends crucially on the nature of the spin bath and its coupling to the central spin. In this work we investigate the decoherence of a central spin which is coupled non-uniformly to a spin chain by means of the time-dependent density matrix renormalization group technique. Using this technique the coupling between the central spin and the spin chain can take any form, in contrast to the typical uniform or on-site coupling taken in the literature. We have studied the resulting spin decoherence induced by spin chains in the Ising, XY, XXZ, and Heisenberg universality classes. Connection between the decoherence the quantum phase transition of the spin chain is discussed.

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