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Two Ising-coupled quantum spins in the presence of a bosonic bath PETER P. ORTH, KARYN LE HUR, Department of Physics, Yale University, New Haven, CT 06520, USA, DAVID ROOSEN, WALTER HOFSTETTER, Institut fuer Theoretische Physik, Goethe Universitaet, 60438 Frankfurt/Main, Germany — A system of two coupled quantum spins in contact with a common harmonic oscillator bath is a paradigm for the study of the interplay between quantum control and dissipation. It also constitutes the elementary building block of a quantum computer. Using the time dependent numerical renormalization group (TD-NRG), we study the system's rich dissipative dynamics arising from the competition between spin-spin and spin-bath coupling, and compare it to a perturbative Bloch-Redfield approach. As an example, we show that spin oscillations can be synchronized using the bath induced interaction. We also address how the well-known localization quantum phase transition of the single spin-boson model is affected by the presence of a second spin. We employ the NRG to calculate the zero temperature phase diagram as a function of dissipation and Ising coupling, for both ohmic and subohmic baths. In the subohmic case, we study the scaling of spin expectation values and entanglement entropy close to the phase transition.

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