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Bath Induced Interactions in the Spin-Boson Model in One Dimension MATTHEW BUTCHER, Rice University, JEDEDIAH PIXLEY, University of Maryland, College Park, ANDRIY NEVIDOMSKYY, Rice University — The spin-boson model and its various incarnations have been widely studied for their rich physics and potential for controlling entangled quantum states. In this context, we consider a one-dimensional lattice of Ising spins in a transverse field, coupled to a dissipative bosonic bath with an Ohmic density of states. The separation dependence of two coupled spins has been studied [1], but for more spins the full range of effective interactions have not been included. To study the effects of these induced interactions, we employ a quantum-to-classical mapping [2] to derive the action of the corresponding classical Ising model in two dimensions, which includes time-retarded and long-range spatial interaction terms between all spins. We investigate the correlation functions and critical properties in the classical Monte Carlo simulations, using parallel tempering and efficient update algorithms to mitigate the difficulties of dealing with a highly frustrated spin system. We also investigate the finite size effects.

References:
[1] D. P. S. McCutcheon, A. Nazir, S. Bose, A. J. Fisher, Phys. Rev. B, **81**, 235321 (2010).
[2] S. Sachdev, *Quantum Phase Transitions* (Cambridge University Press, Cambridge, England, 1999).

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