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**Reservoir engineering and many-body decoherence in the quantum Ising model** LINCOLN CARR, DANIEL JASCHKE, INES DE VEGA, Colorado School of Mines — We present quantitative predictions for quantum simulator experiments on Ising models from trapped ions to Rydberg chains and show how the thermalization, and thus decoherence times, can be controlled by considering common, independent, and end-cap couplings to the bath. We find (i) independent baths enable more rapid thermalization in comparison to a common one; (ii) the thermalization timescale depends strongly on the position in the Ising phase diagram; (iii) for a common bath larger system sizes show a significant slowdown in the thermalization process; and (iv) finite-size scaling indicates a subradiance effect slowing thermalization rates toward the infinite spin chain limit. We find it is necessary to treat the full multi-channel Lindblad master equation rather than the commonly used single-channel local Lindblad approximation to make accurate predictions on a classical computer. This method reduces the number of qubits one can practically classical simulate by at least a factor of 4, in turn showing a quantum advantage for such thermalization problems at a factor of 4 smaller qubit number for open quantum systems as opposed to closed ones. Thus, our results encourage open quantum system exploration in noisy intermediate-scale quantum technologies.

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