Abstract Submitted
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Quantum Decoherence at Finite Temperatures: Theory and Computations[1] M.A. NOVOTNY, Mississippi State University, FENGPING JIN, Julich Supercomputing Centre, SEIJI MIYASHITA, University of Tokyo, SHENGJUN YUAN, Radboud Universiteit, HANS DE RAEDT, University of Groningen, KRISTEL MICHIELSEN, Julich Supercomputing Centre — The decoherence of a finite quantum system S coupled to a finite quantum environment E is considered, where the entirety S+E is a closed quantum system. The entirety is prepared in a canonical thermal state at a finite temperature. By applying perturbation theory, we find closed form expressions for measures of decoherence and thermalization of S in terms of the free energies of S and E. Hence we have quantified how difficult it is to decohere a particular finite quantum system S at a fixed temperature, the result being a function of the free energy of S. We have also quantified how potent a particular finite Hilbert space environment E at a fixed temperature is at decohering a generic quantum system. To test these predictions, we performed both real and imaginary time calculations for the Schrödinger equation for an entirety with up to 40 quantum spins. The large-scale calculations (vectors in Hilbert space with length up to $2^{40} \approx 10^{12}$) validate our predictions for all temperatures. Preprint arXiv:1502.03996.

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