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Collective decoherence of nuclear spin clusters LEONID FEDICHKIN, Clarkson University, ARKADY FEDOROV, Institut fur Theoretische Festkorperphysik, Universitat Karlsruhe — The problem of dipoledipole decoherence of nuclear spins is considered for strongly entangled spin clusters. We consider the pure dephasing part of the dipoledipole interaction which can be classically interpreted as a random field fluctuating along the quantization axes. Due to the long (but finite) range nature of dipoledipole interaction this field is expected to be partially correlated at the sites of different spins in the cluster. Consequently our results show that the dynamics of the entangled spin cluster can be described as the decoherence due to interaction with a composite bath consisting of fully correlated and uncorrelated parts. The correlated term causes the slower decay of coherence at larger times. The decoherence rate scales up as a square root of the number of spins, giving the linear scaling of the resulting error. Our theory is consistent with recent experiments reported on decoherence of correlated spin clusters.

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