

The qubit states decoherence in antiferromagnet-based nuclear spin model of quantum register

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This study deals with the further development of nuclear spin model of scalable quantum register, which presents the one-dimensional chain of the magnetic atoms with nuclear spins $1/2$, substituting the basic atoms in the plate of nuclear spin-free easy-axis 3D antiferromagnet. The decoherence rates of one qubit state and entanglement state of two removed qubits and longitudinal relaxation rates are caused by the interaction of nuclear spins-qubits with virtual spin waves in antiferromagnet ground state were calculated. It was considered also one qubit adiabatic decoherence, is caused by the interaction of nuclear spin of quantum register with nuclear spins of randomly distributed isotopes, substituting the basic nuclear spin-free isotopes of antiferromagnet. We have considered finally encoded DFS (Decoherence-Free Subspaces) logical qubits are constructed on clusters of the four-physical qubits, given by the two states with zero total angular momentum.

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