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Anisotropic spin-echo dynamics: Maximizing purity for hole spins in quantum dots WILLIAM COISH, XIAOYA JUDY WANG, McGill University, STEFANO CHESI, RIKEN, Japan — We theoretically study spin-echo dynamics for a central spin qubit coupled anisotropically to a spin bath. Our main focus is on hole spins in quantum dots, with an anisotropic hyperfine coupling to nuclear spins. Through direct application of a systematic Magnus expansion, we analyze the purity of the spin qubit. The purity can characterize non-classical correlations between the spin qubit and bath and provides a figure-of-merit for preserving an ancilla qubit in some initial state. Interestingly, we show that the purity can be preserved to a greater degree by ‘parking’ the spin qubit in a superposition of Zeeman eigenstates, rather than allowing it to align along an applied magnetic field. The procedure reported here provides a general strategy for preserving ancilla qubits in the presence of anisotropic interactions.

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