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Spin Decoherence and Maxwell Angels¹

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The advantages of a quantum machine are rooted in the coherent superposition of its states. In the paradigmatic quantum system of a single-electron in the environment of a quantum dot of interacting nuclear spins, how does its spin coherence decay? Is the coherence doomed to dissipate (the H-theorem)? I shall present a theory of decoherence with a simple quantum explanation with no a priori stochastic assumption, based on two solutions [1,3] of the many-body dynamics of the single electron spin and a mesoscopic number of nuclear spins. The theory is followed by a description of the principle of how the coherence lost can be restored by controlling only the electron spin [2,4]. Work done in collaboration with Wang Yao, Renbao Liu, and Semion Saikin.

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