Spin dephasing in a silicon double quantum dot and its implications for spin qubit shuttling

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I will discuss spin dephasing in two scenarios that arise in the context of coherent shuttling of an electron spin qubit. In the first one, an electron is shuttled through a chain of tunnel-coupled quantum dots via adiabatic sweeps of interdot detunings. In presence of realistic inhomogeneity of spin splittings in neighbouring quantum dots, both high- and low-frequency noise in detuning determines the dephasing of the electron shuttled between the two dots at low shuttling velocities [1]. In the second scenario, we consider dynamics of a spatially separated spin singlet S in a double quantum dot, in a setup in which one of the dots can also be moved to a distance *d* from the stationary one (and back) with the use of conveyor-belt shuttler [2,3,4]. In such an experiment, dephasing of S-T_0 superposition is suppressed, compared to the case of stationary dots, due to motional narrowing of the influence of quasi-static local noises in spin splitting [3]. For the single-spin Zeeman splitting close to the valley splitting in each of the dots, spin-valley coupling leads to mixing of S and T_0 states with one of polarized triplets. I will discuss how the spin-valley mixing modifies the way in which spin-splitting fluctuations in each dot affect the S-T_0 coherence, and how valley splitting fluctuations become active at the dephasing of the spatially separated singlet near the spin-valley hotspot.

References

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Figures

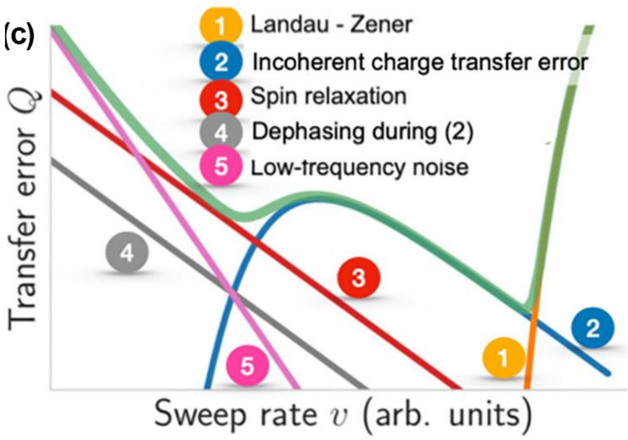

Figure 1: Dependence of error in spin-coherent electron transfer on the interdot detuning sweep rate v for five mechanisms that will be discussed (adapted from [1]).