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**Decay of the rotating-frame spin echo and its application to sensing the local environment of a NV center**[1] VAGHARSH MKHITARYAN, XIAO-XUAN HUANG, VIATCHESLAV DOBROVITSKI, Ames Laboratory and Iowa State University, Ames, Iowa 50011, USA — We study a NV electron spin subjected to a strong driving field, which reverses its sign with the period $\tau$ (multi-pulse Solomon echo), and analyze the rotating-frame echo decay at long times (large number of reversals). The form and the rate of the echo decay is calculated analytically and numerically, by modelling the decohering spin environment as a magnetic noise. For short $\tau$ the decay is strongly suppressed, being of the 4th order in $\tau$ (vs. 3rd order in the regular Carr-Purcell decoupling, and 2nd order in the standard continuous-wave decoupling). This ensures exceptional decoupling stability with respect to the slow fluctuations of the external magnetic field. Moreover, we find that the decay rate depends non-monotonically on the correlation time of the environment, decreasing for both very fast and very slow spin baths. Using these results, we demonstrate how the multi-pulse version of the Solomon echo can be harnessed to sense and analyze in detail the local spin environment of the NV center.

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