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Spin Exchange oscillations between distant quantum dots TAKAFUMI FUJITA, TIM BAART, Delft University of Technology, CHRISTIAN REICHL, WERNER WEGSCHEIDER, ETH Zurich, LIEVEN VANDERSYPEN, Delft University of Technology — Interactions mediated by long-range quantum coherence lie at the heart of important phenomena in many different fields. Charge transfer during oxidative stress in DNA [1], reactions in photosynthetic molecules [2], and behaviour of cuprate superconductors [3] are all described by tunnelling via virtual hopping. Such mechanism may also provide new ways of using quantum dots for fault tolerant quantum information processing [4]. In the presence of long-range tunnel coupling mediated by virtual occupation of intermediate levels, superexchange interactions can induce coherent oscillations between two distant electron spins. We implement this scheme in a linear array of three quantum dots with one electron on each of the outer dots. We observe coherent exchange oscillations between the two spins, and the oscillation frequency is controlled by the detuning of the electrochemical potential of the dot in between. Spin exchange at a distance may provide a new route for scaling up electron spin qubits using quantum dots. [1] B. Giese, et al, Nature 412, 318-320 (2001). [2] X.F. Wang, et al, Phys. Rev. Lett. 97,106602 (2006). [3] C. Kim, et al, Phys. Rev. Lett. 80, 4245 (1998). [4] F. Braakman, et al, Nature Nano. 8, 432-437 (2013).

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