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Driven coherent oscillations of a single electron spin in a quantum dot FRANK KOPPENS, CHRISTO BUIZERT, KLAAS-JAN TIELROOIJ, IVO VINK, KATJA NOWACK, TRISTAN MEUNIER, LEO KOUWENHOVEN, LIEVEN VANDERSYPEN, Kavli Institute of Nanoscience Delft — The ability to control the quantum state of a single electron spin in a quantum dot is at the heart of recent developments towards a scalable spin-based quantum computer. In combination with the recently demonstrated controlled exchange gate between two neighbouring spins [1], driven coherent single spin rotations would permit universal quantum operations. In this talk, I will discuss the experimental realization of single electron spin rotations in a gate-defined GaAs double quantum dot. We coherently control the quantum state of the electron spin by applying short bursts of an on-chip generated oscillating magnetic field [2]. This allows us to observe up to eight Rabi oscillations of the electron spin in a microsecond burst. Via Ramsey-type pulse sequences we measure an apparent time-averaged coherence time which is limited by the hyperfine interaction with the nuclear spins. We erase these nuclear spin effects to a large extend via spin-echo pulse sequences and recover the intrinsic coherence time. [1] J.R. Petta et al., Science 309, 2180–2184 (2005). [2] F.H.L. Koppens et al., Nature 442, 766-771 (2006).

Frank Koppens

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