Abstract Submitted
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Theory of 1- and 3-electron g-factors in Si quantum dots for spin-qubit manipulation RUSKO RUSKOV, CHARLES TAHAN, Laboratory for Physical Sciences, MICHAEL E. FLATTÉ, University of Iowa, MENNO VELDHORST, ANDREW DZURAK, University of New South Wales — Although the spin-orbit interaction in silicon is very weak, it is possible to map out the electron spin resonance (ESR) frequency with high precision in MOS quantum dot (QD) qubits by using isotopically purified silicon [1]. Using this method, the g-factor with 1 and 3 electrons in the dot has been measured with an in-plane magnetic field and as a function of the applied electric field perpendicular to the interface (along the growth direction ¡001¿) [2]. Here, we present a theoretical model of the electron g-factor in silicon QDs. We show that the results could be explained with the effect of an electron envelope function deformation in the confining interface region. Since the QD orbital splitting is much larger than the valley splitting at the interface, the system with 1 or 3 electrons probes the valley states at the interface, and the sign and size of the g-factor renormalization (order of tens of MHz in the chosen range of the electric field) could be explained via the spin-orbit 2D interaction induced at the interface. Electrical g-factor control opens the possibility of fast and all-electric manipulation of a few electron spin-qubit, without the need of a nanomagnet or a nuclear spin-background.

[1] Veldhorst et al, Nat.Nanotech(2014)
[2] Veldhorst et al, (Unpublished)

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