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Valley dependent g-factor anisotropy in Silicon quantum dots RIFAT FERDOUS, Purdue University, ERIKA KAWAKAMI, PASQUALE SCARLINO, MICHAL NOWAK, QuTech and Kavli Institute of Nanoscience, GERHARD KLIMECK, Purdue University, MARK FRIESEN, SUSAN N. COPPERSMITH, MARK A. ERIKSSON, University of Wisconsin-Madison, LIEVEN M. K. VANDERSYPEN, QuTech and Kavli Institute of Nanoscience, RAJIB RAHMAN, Purdue University — Silicon (Si) quantum dots (QD) provide a promising platform for a spin based quantum computer, because of the exceptionally long spin coherence times in Si and the existing industrial infrastructure. Due to the presence of an interface and a vertical electric field, the two lowest energy states of a Si QD are primarily composed of two conduction band valleys. Confinement by the interface and the E-field not only affect the charge properties of these states, but also their spin properties through the spin-orbit interaction (SO), which differs significantly from the SO in bulk Si. Recent experiments have found that the g-factors of these states are different and dependent on the direction of the B-field. Using an atomistic tight-binding model, we investigate the electric and magnetic field dependence of the electron g-factor of the valley states in a Si QD. We find that the g-factors are valley dependent and show 180-degree periodicity as a function of an in-plane magnetic field orientation. However, atomic scale roughness can strongly affect the anisotropic g-factors. Our study helps to reconcile disparate experimental observations and to achieve better external control over electron spins in Si QD, by electric and magnetic fields.

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