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Large Stark effect for Li donor spins in Si LUKE PENDO, ERIN HANDBERG, South Dakota School of Mines, VADIM SMELYANSKIY, NASA Ames Research Center, ANDRE PETUKHOV, South Dakota School of Mines — We study the effect of a static electric field on lithium donor spins in silicon. The anisotropy of the effective mass leads to the anisotropy of the quadratic Stark susceptibility, which we determined using the Dalgarno-Lewis exact summation method [1]. The theory is asymptotically exact in the field domain below Li-donor ionization threshold, relevant to the Stark-tuning Electron Spin Resonance (ESR) experiments [2]. With the calculated Stark susceptibilities at hand, we were able to predict and analyze several important physical effects. In particular, we demonstrate that the Stark effect anisotropy, combined with unique valley-orbit splitting of a Li donor in Si, spin-orbit interaction and specially tuned external stress, may lead to a very strong modulation of the donor spin g-factor by the electric field. Also we investigate the influence of random strains on the g-factor shifts and quantify the random strain limits and requirements to Si material purity necessary to observe the ESR-Stark shifts experimentally. Finally, we discuss possible applications of our results to quantum information processing with Li spin qubits in Si.

[1] A. Dalgarno and J. T. Lewis, Proc. Roy. Soc. 233, 70 (1955).
[2] F. R. Bradbury et al. Phys. Rev. Lett. 97, 176404 (2006).

[X] Prefer Oral Session
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Luke Pendo
luke.pendo@gmail.com
South Dakota School of Mines

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