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Experimental Stark tuning the donor electron spin resonance in silicon[1] FORREST BRADBURY, ALEXEI TYRYSHKIN, GUILLAUME SABOURET, Princeton University, THOMAS SCHENKEL, Lawrence Berkeley Nat'l Lab, STEPHEN LYON, Princeton University — We measure the hyperfine and spin-orbit shifts due to electric fields applied to bound electrons in silicon. The ability to electrically tune resonances allows for selective single qubit operations on electron spins without localized magnetic fields. We study ^{31}P donors in natural silicon epilayers and ^{121}Sb donors implanted into isotopically purified ^{28}Si. The E-fields ($\sim$kV/cm) are applied by lithographically-patterned, interdigitated metal top-gates. Small shifts in resonant energies are measured by pulsed electron spin resonance using a modified two-pulse (Hahn) spin echo experiment with an electrical pulse applied to the gates between microwave pulses. At $B_0 \approx 0.35$T, we find the 2^{nd} order hyperfine and spin-orbit Stark shifts to be comparable in magnitude. Though the literature has heretofore focused on the hyperfine Stark shift, we predict that the spin-orbit Stark shift will be the dominant tuning parameter at higher magnetic fields where a future quantum computer is likely to operate.

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