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Method for Full Bloch-Sphere Control of a Localized Spin in a Quantum Dot via a Single Electrical Gate JOSEPH PINGENOT, CRAIG E. PRYOR, MICHAEL E. FLATTÉ, Department of Physics and Astronomy and Optical Science and Technology Center, University of Iowa — Manipulating individual spins in solids requires quickly and coherently reorienting localized spins while leaving neighboring spins unaffected. Difficulties confining oscillating magnetic fields have motivated alternate approaches that use electric fields to change the local magnetic environment, including moving an electron within a hyperfine field gradient or fringe-field gradient. Higher temperatures require spins to be localized in much smaller quantum dots, where these techniques are less effective. In contrast, g-tensor manipulation techniques[1] couple an electric field to the spin via the spin-orbit interaction, and should be scalable to small dots with large confinement. Here we calculate the g-tensor of a single electron in a small quantum dot and show the symmetry of its electric field dependence permits full Bloch sphere control of the spin using an electric field applied in a single direction. We find the spin manipulation frequency of an InAs/GaAs QD in 1 Tesla exceeds 150 MHz. We acknowledge support of an ONR MURI and an NSF NIRT. [1] Kato et al. Nature 299, 1201 (2003)

Joseph Pingenot
Department of Physics and Astronomy and Optical Science and
Technology Center, University of Iowa

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