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High Speed Single Dopant Spin Manipulation with a Single Electrical Gate V. POVILUS, University of Iowa, J.-M. TANG, University of New Hampshire, M.E. FLATTÉ, University of Iowa — The smallest semiconductor spintronic devices may involve single-spin control[1]. Mn ions with a bound hole in GaAs can be controlled electrically[2]. Through the spin-orbit interaction an oscillating electric field can manipulate the spin orientation of the spin-1 Mn ion-hole ground state. In an effort to create a scalable device design using a single gate we propose a configuration with fixed electric field direction. Static electric and magnetic fields are chosen to fix the lowest energy splitting at 5 GHz and increase the energy of the highest state, creating a nearly-degenerate doublet. Within this configuration, a static magnetic field of 2.5 T and an electric field that never exceeds 200 kV/cm, we predict Rabi periods on the order of picoseconds with visibilities near 90%. This work was supported by NRI through WIN.

[1] D. D. Awschalom, N. Samarth, and D. Loss, eds., Semiconductor Spintronics and Quantum Computation (Springer Verlag, Heidelberg, 2002).
[2] J.-M Tang, Jeremy Levy, and M. E. Flatté, Phys. Rev. Lett. 97, 106803 (2006).

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