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STM studies of an atomic-scale gate electrode formed by a single charged vacancy in GaAs DONGHUN LEE, DAVID DAUGHTON, JAY GUPTA, The Ohio State University — Electric-field control of spin-spin interactions at the atomic level is desirable for the realization of spintronics and spin-based quantum computation. Here we demonstrate the realization of an atomic-scale gate electrode formed by a single charged vacancy on the GaAs(110) surface[1]. We can position these vacancies with atomic precision using the tip of a home-built, low temperature STM. Tunneling spectroscopy of single Mn acceptors is used to quantify the electrostatic field as a function of distance from the vacancy. Single Mn acceptors are formed by substituting Mn adatoms for Ga atoms in the first layer of the *p*-GaAs(110) surface[2]. Depending on the distance, the in-gap resonance of single Mn acceptors can shift as much as 200meV. Our data indicate that the electrostatic field decays according to a screened Coulomb potential. The charge state of the vacancy can be switched to neutral, as evidenced by the Mn resonance returning to its unperturbed position. Reversible control of the local electric field as well as charged states of defects in semiconductors can open new insights such as realizing an atomic-scale gate control and studying spin-spin interactions in semiconductors. http://www.physics.ohio-state.edu/$\sim $jgupta [1] D. Lee and J.A. Gupta (in preparation) [2] D. Kitchen et al., Nature **442**, 436-439 (2006)

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