Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Atomically precise control of a coupled donor-quantum dot system in silicon JOSEPH SALFI, BEN VOISIN, The University of New South Wales, ARCHANA TANKASALA, Purdue University, JUANITA BOCQUEL, The University of New South Wales, MUHAMMAD USMAN, The University of Melbourne, MICHELLE SIMMONS, The University of New South Wales, LLOYD HOLLENBERG, The University of Melbourne, RAJIB RAHMAN, Purdue University, SVEN ROGGE, The University of New South Wales — Single donors in silicon have long spin coherence times of interest for quantum computing. While quantum dots are promising candidates to couple donor spin qubits[1,2], the experimental tunability of the interactions and the influence of valley degrees of freedom (recently measured in donors[3]) in donor-quantum dot coupling remain open questions. We have directly measured the spectrum and wavefunctions of a donor interacting with a single-electron quantum dot that follows a movable scanned probe tip with sub-nm accuracy. Analysis of the two-electron energy as a function of the quantum dot position reveals no detectable lattice-incommensurate "exchange oscillations", even though donor state and its valley population is robust to quantum dot potential. This contrasts direct donor-donor exchange, which is predicted to depend sensitively on donor position due to valley interference. This result has important implications for obtaining robust interactions among donors in a surface code quantum computer. [1] G Pica et al, Phys. Rev. B. 93, 035306 (2016). [2] Gonzalez-Zalba, Phys. Rev. X 5 031024 (2015). [3] Salfi et al, Nature Materials, 13, 606 (2014). [4] B. Koiller et al, Phys. Rev. Lett. 88, 027903 (2001).

Joseph Salfi
The University of New South Wales

Date submitted: 11 Nov 2016 Electronic form version 1.4