Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

**Local electrical control of a single-atom spin qubit in a continuous microwave field**[1] ANDREA MORELLO, ARNE LAUCHT, JUHA MUHONEN, FAHD MOHIYADDIN, RACHPON KALRA, JUAN DEHOLLAIN, SOLOMON FREER, FAY HUDSON, MENNO VELDHORST, ANDREW DZURAK, UNSW Australia, KOHEI ITOH, Keio University, RAIJB RAHMAN, GERHARD KLIMECK, Purdue University, JEFFREY MCCALLUM, DAVID JAMIESON, University of Melbourne — An ideal physical system to encode quantum information should be well isolated from its environment, but locally addressable and readable. Kane's proposal for a silicon spin-based quantum computer suggested tuning the qubit in/out of resonance with a global oscillating magnetic field by applying a local electric field and exploiting the Stark shift of the electron-nuclear hyperfine interaction ("*A*-gate"). We demonstrate universal single-qubit logic gates on both the electron and $^{31}P$ nuclear spin of a single phosphorus atom in silicon, subject to an always-on microwave field, and operated via an *A*-gate controlled by nanometre-scale electrodes. The experiment is facilitated by the exceptionally sharp spin resonance frequencies in the nuclear-spin-free $^{28}Si$ host material. Randomized benchmarking yields quantum gate fidelities $\geq 99$ %, and the millisecond-long spin coherence times remain identical to those obtained by pulsed spin resonance. This method provides a natural pathway to address arbitrarily many qubits in large-scale quantum computers.

[1]Funded by the Australian Research Council (CE11E000127) and the U.S. Army Research Office (W911NF-13-1-0024)

Andrea Morello
UNSW Australia

Date submitted: 14 Nov 2014 Electronic form version 1.4