Abstract Submitted for the MAR10 Meeting of The American Physical Society

Towards Quantum Computing with Electron Spin Ensembles DAVID SCHUSTER, ADAM SEARS, Yale University, JANUS WESENBERG, ARZHANG ARDAVAN, ANDREW BRIGGS, JOHN MORTON, University of Oxford, KLAUSS MOELMER, University of Aarhus, ROBERT SCHOELKOPF, Yale University — We describe a recent proposal [1] where a register of quantum bits is encoded into different collective electron spin wave excitations in a solid medium. Coupling to spins is enabled by locating them in the vicinity of a superconducting transmission line cavity, and making use of their strong collective coupling to the quantized radiation field. Accessing different spin waves can be achieved by applying gradient magnetic fields across the sample [2], while a Cooper pair box, resonant with the cavity field, may be used to carry out one- and two-qubit gate operations. We also present experimental progress towards coupling spins to on-chip superconducting cavities.

[1] Wesenberg, et. al. Phys. Rev. Lett. 103, 070502 (2009)

[2] Anderson, et. al. J. Ap. Phys. 26, 11-1324 (1955)

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Date submitted: 09 Dec 2009

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