Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Quantum error correction with nuclear spins in diamond TIM HUGO TAMINIAU, QuTech, Delft University of Technology, JULIA CRAMER, M. A. ROL, NORBERT KALB, Kavli Institute of Nanoscience, Delft University of Technology, V. V. DOBROVITSKI, Ames Laboratory and Iowa State University, RONALD HANSON, Kavli Institute of Nanoscience, Delft University of Technology — Quantum error correction is essential for large-scale quantum information processing. By encoding a quantum state in an entangled state of multiple qubits errors can be detected and corrected without obtaining information about the encoded state [1,2]. In this talk I will present quantum error correction based on spins in diamond. We used the electron spin of a nitrogen-vacancy centre to selectively initialize, control and read out multiple carbon-13 nuclear spins in the surrounding spin bath [3]. With these spin we implemented a three-qubit quantum-error-correction protocol and demonstrated the robustness of the encoded state against applied errors [1]. Furthermore, I will discuss how working at cryogenic temperatures will make it possible to realize error correction based on projective multi-qubit parity measurements [4], as envisioned in most modern error correction codes.
[1] T. H. Taminiau et al., Nature Nanotech. 9, 171 (2014) [2] G. Waldherr et al., Nature 506, 204 (2014) [3] T. H. Taminiau et al., Phys. Rev. Lett. 109, 137602 (2012) [4] W. Pfaff et al., Nature Phys. 9, 29 (2013)

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Date submitted: 14 Nov 2014 Electronic form version 1.4