Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Low magnetic field anomalies of spin relaxation in silicon in the low temperature limit STEFANIE TENBERG, SERWAN ASAAD, ARNE LAUCHT, RACHPON KALRA, FAY E. HUDSON, Univ of New South Wales, KOHEI M. ITOH, Keio University, DAVID N. JAMIESON, JEFFREY C. MCCALLUM, Univ of Melbourne, ANDREW S. DZURAK, ANDREA MORELLO, Univ of New South Wales — The electron spin relaxation rate of donors in silicon is predicted to follow a magnetic field dependence of $1/T_1 \propto B^5$ at low temperatures, where only spontaneous emission of phonons is relevant [1]. This behaviour has been observed in experiments on individual P donors [2,3]. However, these measurements also showed a deviation from the theoretical prediction at low fields (<2 T). Here we present an extensive analysis of single donor relaxation rates at low magnetic fields, down to 0.3 T. To maintain a high spin readout contrast at low field we use steered initialisation, where a real-time feedback loop corrects for spin loading errors. Using a vector magnet, we investigate the dependence of the relaxation rate on the magnetic field direction. This allows us to disentangle valley-repopulation and single-valley contributions [1], and to study the potential impact of extrinsic relaxation mechanisms, such as evanescent-wave Johnson noise [4].
[1] F.A. Zwanenburg et al., Rev. Mod. Phys. 85, 961 (2013). [2] A. Morello et al., Nature(London) 467, 687 (2010). [3] Y.-L. Hsueh et al., Phys. Rev. Lett. 113, 245406 (2014). [4] L. S. Langsjoen et al., Phys. Rev. B 89, 115401 (2014).

Stefanie Tenberg
Univ of New South Wales

Date submitted: 15 Nov 2016 Electronic form version 1.4