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Single-shot electrical readout of an ensemble nuclear spin memory in silicon DANE R. MCCAMEY, School of Physics, University of Sydney, J. VAN TOL, National High Magnetic Field Laboratory, Florida State University, G. W. MORLEY, London Centre for Nanotechnology and Department of Physics and Astronomy, University College London, C. BOEHME, Department of Physics and Astronomy, University of Utah — Storing information in spin is widely recognized as a promising technological driver. However, the ability to interact with, and thus control electron spin implies a reasonable coupling to the environment, and thus a limited spin lifetime. This problem can be overcome by using nuclear spins for long term information storage even though mapping nuclear spin information onto device currents has remained challenging. Here, we report on an electrically readable nuclear spin memory implemented using phosphorus donors in silicon [1]. Donor electron spins can be used to encode logical information, which is then transferred to the nuclei. The state can be stored in the nuclear spin and then read out electrically via the hyperfine coupling with the electron. We show that information can be stored in the nuclear spin for longer than 100 seconds, that the information can be read back single shot, and that repetitive measurement does not degrade the stored information. Other nuclei, such as the spin 1/2 ^{29}Si, can also be used, pointing to the possibility of a nuclear spin memory register. [1] D. R. McCamey, J. van Tol, G. W. Morley and C. Boehme. Science, in press (2010)

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