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**Nuclear Spin Polarization of Phosphorus Donors in Silicon. Direct Evidence from 31P-Nuclear Magnetic Resonance**[1] PATRYK GUMANN, Institute for Quantum Computing, University of Waterloo, CHANDRASEKHAR RAMANATHAN, Deparment of Physics and Astronomy, Dartmouth College, OM PATANGE, Waterloo Institute for Nanotechnology & Institute for Quantum Computing, University of Waterloo, OSAMA MOUSSA, Institute for Quantum Computing, University of Waterloo, MIKE THEWALT, Department of Physics, Simon Fraser University, HELGE RIEMANN, NIKOLAY ABROSIMOV, Leibniz-Institut fuer Kristallzuechtung, PETER BECKER, PTB Braunschweig, HANS-JOACHIM POHL, VITCON Projectconsult GmbH, KOHEI ITOH, School of Fundamental Science and Technology, Keio University, DAVID G. CORY, Institute for Quantum Computing, University of Waterloo — We experimentally demonstrate the optical hyperpolarization and coherent control of $^{31}$P, nuclear spins in single crystal silicon via the inductive readout of the nuclear magnetic resonance (NMR) signal of $^{31}$P at a concentration of 1.5 x $10^{15}$ $cc^{-1}$. The obtained polarization is sufficient the $^{31}$P spin polarization of 1.17 x $10^{15}$ in a 10 mm x 10 mm sample, observed in one FID with signal-to-noise ration of 113. The linewidth is 800 Hz. The Hahn echo pulse sequence reveals a $^{31}$P $T_2$ time of 0.42 s at 1.6 K, which was extended by the Carr Purcell cycle to 1.2 s at the same temperature. The maximum build-up of the nuclear polarization was achieved within ∼577 seconds, at 4.2 K, in 6.7 T, using optical excitations provided by an infra-red laser.

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