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Dynamic Nuclear Polarization at high field of the ^{31}P spins in phosphorus-doped silicon JOHAN VAN TOL, LOUIS-CLAUDE BRUNEL, National High Magnetic Field Lab at Florida State University — Phosphorus doped Silicon has been suggested as a prime candidate for the realization of Quantum Computers. Either or both electron or nuclear spins of the shallow donor centers could serve as qubits. Electron and nuclear spins can be manipulated by microwave and radiofrequency pulses respectively, while electric fields can be used to tune spin-spin interaction. The proposals concerning a Si-based approach for quantum computing rely on exchange interaction and relaxation mechanisms that need further characterization. In particular the relaxation times in Si:P are dependent on dopant concentration, strain, temperature, magnetic field, and the ^{29}Si I= $1/2$ nuclear spins. We present a multifrequency study of the relaxation and dynamic nuclear polarization mechanisms and nuclear relaxation rates in several relevant Si:P samples by cw and pulsed EPR and pulsed ENDOR at 9.6 GHz, 95 GHz, and 240 GHz. Nuclear polarization of the^{31}P nuclei in excess of 90% was achieved at 3 K at 8.5 Tesla, while the nuclear spin-lattice relaxation time exceeds 30 minutes at these temperatures in natural abundance Si samples.

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