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Polytype control of spin qubits in silicon carbide[1] A.L. FALK, B.B. BUCKLEY, G. CALUSINE, W.F. KOEHL, A. POLITI, D.D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, California 93106, USA, V.V. DOBROVITSKI, Ames Laboratory and Iowa State University, Ames, Iowa 50011, USA, C.A. ZORMAN, P. X.-L. FENG, Case School of Engineering, Case Western Reserve University, Cleveland, OH 44016, USA
— The search for coherently addressable spin states in technologically important materials is a promising direction for solid-state quantum information science. Silicon carbide, a particularly suitable target, is not a single material but a collection of about 250 known polytypes, each with its own set of physical properties and technological applications. We show that in spite of these differences, the 4H-, 6H-, and 3C-SiC polytypes all exhibit optically addressable spins with long coherence times [1]. These results include room temperature spins in all three polytypes and suggest a new method for tuning quantum states using crystal polymorphism. Long spin coherence times allow us to use double electron-electron resonance to measure magnetic dipole interactions between spin ensembles in inequivalent lattice sites of the same crystal. Since such inequivalent spin have distinct optical and spin transition energies, these interactions could lead to dipole-coupled networks of separately addressable spins.

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Abram Falk
Center for Spintronics and Quantum Computation,
University of California, Santa Barbara, California 93106, USA

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