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Electrical Manipulation of Spin Qubits in Li-doped Si ANDRE PETUKHOV, LUKE PENDO, ERIN HANDBERG, South Dakota School of Mines, VADIM SMELYANSKIY, NASA Ames Research Center — We propose a complete quantum computing scheme based on Li donors in Si under external biaxial stress. The qubits are encoded on the ground state Zeeman doublets and coupled via long-range spin-spin interaction mediated by acoustic phonons. This interaction is unique for Li donors in Si due to their inverted electronic structure. Our scheme takes advantage of the fact that the energy level spacing in $1s$ Li-donor manifold is comparable with the magnitude of the spin-orbit interaction. As a result the Li spin qubits can be placed 100 nm apart and manipulated by a combination of external electric field and microwave field impulses. We present a specially-designed sequence of the electric field impulses which allows for a typical time of a two-qubit gate ~ 1 μs and a quality factor $\sim 10^{-6}$. These estimates are derived from detailed microscopic calculations of the quadratic Stark effect and electron-phonon decoherence times.

Andre Petukhov
South Dakota School of Mines

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