Electroelastic Hyperfine Tuning of Phosphorus Donors in Silicon

LUKAS DREHER, TIMON A. HILKER, Walter Schottky Institut, Technische Universität München, Am Coulombwall 3, 85748 Garching, Germany, ANDREAS BRANDLMAIER, SEBASTIAN T.B. GOENNENWEIN, HANS HUEBL, Walther-Meissner-Institut, Bayerische Akademie der Wissenschaften, Walther-Meissner-Strasse 8, 85748 Garching, Germany, MARTIN STUTZMANN, MARTIN S. BRANDT, Walter Schottky Institut, Technische Universität München, Am Coulombwall 3, 85748 Garching, Germany — We demonstrate an electroelastic control of the hyperfine interaction between nuclear and electronic spins opening an alternative way to address and couple spin-based qubits. The hyperfine interaction is measured by electrically detected magnetic resonance in phosphorus-doped silicon epitaxial layers employing a hybrid structure consisting of a silicon-germanium virtual substrate, a piezoelectric actuator, and a loop-terminated coplanar strip line for on-chip microwave magnetic-field generation. By applying a voltage to the actuator, the hyperfine interaction is changed by up to 0.9 MHz, which would be enough to address spin-qubits in isotopically purified $^{28}$Si with a sufficient fidelity under optimized conditions.

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