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Electronic control and readout of qubit states in Si:Li-based quantum computing system V.V. OSIPOV, V.N. SMELYANSKIY, NASA Ames Research Center, Moffett Field, CA, A.G. PETUKHOV, Physics Department, South Dakota School of Mines and Technology — In our previous work (V. N. Smelyanskiy *et al.* Phys. Rev. B **72**, 081304 (2005)) we predicted a gigantically long lifetime of the first excited state of an interstitial lithium donor in silicon. The nature of this effect roots in the anomalous level structure of the $1s$ Li manifold under external stress. Namely, the coupling between the lowest two states of the opposite parity is very weak and occurs via intervalley phonon transitions only. We proposed to use these states under the controlled ac and dc stress to process quantum information. In this work we consider some practical aspects of the proposed scheme such as formation of heavily doped semiconductor electrodes for electrical control of the qubit states and single-qubit readout by means of the resonant tunneling stimulated by polarized infrared radiation. We propose a proof-of-the principle experiment on photo-stimulated time-dependent resonant tunneling in a δ-doped layer of Li donors in Si placed between two n^+ Si electrodes. The effect will be characterized by a high sensitivity of the signal to the polarization of photons and by long-term relaxation of the resonant tunneling photocurrent.

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