Abstract Submitted
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Electric-field driven donor-based charge qubits in semiconductors[1] BELITA KOILLER, Instituto de Fisica, UFRJ, Rio de Janeiro, Brazil, XUEDONG HU, University at Buffalo, SUNY, Buffalo, NY, SANKAR DAS SARMA, CMTC, Department of Physics, UMD, Maryland — We theoretically investigate donor-based charge qubit operation driven by external electric fields [1]. We consider initially a single electron bound to a shallow-donor pair in GaAs: This system allows the basic physics of the problem to be presented. In the case of Si, heteropolar configurations such as P-Sb^+ pairs are also considered. For both homopolar and heteropolar pairs, the multivalley conduction band structure of Si leads to short-period oscillations of the tunnel-coupling strength as a function of the relative position of the donors. However, for any fixed donor configuration, the response of the bound electron to a uniform electric field in Si is qualitatively very similar to the GaAs case, with no valley quantum interference-related effects, leading to the conclusion that valley interference does not prevent the coherent manipulation of donor-based charge qubits by external electric fields. We also discuss the effect of perturbations due to additional distant donors. [1] B. Koiller, X. Hu, and S. Das Sarma, Phys. Rev. B 73, 045319 (2006)

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