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Interface effects on acceptor silicon qubits[1] JOSE CARLOS ABADILLO-URIEL, MARIA JOSE CALDERON, CSIC - Madrid — Recently, proposals of acceptor-based qubits have drawn considerable attention due to the long range strong dipolar inter-qubit coupling and the possibility of exploiting the spin-orbit interaction to couple spins to phonons or oscillating electric fields. Dopant-based quantum computing implementations often require the dopants to be situated close to an interface to facilitate qubit manipulation with local gates. Interfaces not only modify the energies of the bound states but also affect their symmetry. Making use of the successful effective mass theory we study the energy spectra of acceptors in Si or Ge taking into account the quantum confinement, the dielectric mismatch and the central cell effects. The presence of an interface puts constraints to the allowed symmetries and leads to the splitting of the bulk four-fold degenerate ground state in two Kramers doublets. We show that, as the acceptor gets closer to the interface, the entire spectrum is compressed. Inversion symmetry breaking also implies parity mixing which affects the allowed optical transitions. Consequences for acceptor qubits are discussed.

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