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Shallow donor electron spins as qubits in silicon: detection and manipulation MARCO FANCIULLI, ALBERTO DEBERNARDI, Laboratorio Nazionale MDM-INFM — Shallow donors such as P have been proposed as quibits to be used in Si and Si_xGe_{1-x}. External gate control of the hyperfine interaction or of the g-factor have been envisaged for single qubit manipulation, while gate control exchange interaction will provide qubits coupling. We will report on the P shallow donor wave function manipulation via an external electric field. The experimental result, i.e. the electric field dependence of the hyperfine interaction, is compared with theoretical predictions. By means of the envelope function approximation we have computed the energy levels of the shallow P impurity in silicon as well as the hyperfine splitting of the ground state and investigated their dependence on the applied external electric field along the [001] direction. In our numerical calculation we use a Gaussian basis set and we have included valley-orbit interaction and central cell-corrections. Electrically detected spin resonance has been also used to explore the feasibility of the spin detection with enhanced sensitivity using metal/oxide/semiconductor structures.

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