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Coherent manipulation of spin-orbit quantum bits in InSb nanowires STEVAN NADJ-PERGE, JOHAN VAN DEN BERG, SERGEY FROLOV, VLAD PRIBIAG, TU Delft, SEBASTIEN PLISSARD, TU Eindhoven, ERIK BAKKERS, LEO KOUWENHOVEN, TU Delft — Semiconductor nanowires with strong spin-orbit coupling are becoming an attractive platform for spin-based quantum computation. Here we demonstrate coherent transitions between spin-orbit doublet states of individual electrons in indium antimonide (InSb) nanowire quantum dots induced by gigahertz-frequency electric fields. The spin-orbit doublet states form a qubit which initialization and detection relies on Pauli blockade in the double quantum dot (1,1) configuration. The maximum Rabi frequency exceeds 100 MHz and more than 10 periods of coherent oscillations are observed. We estimate fidelities of single qubit rotations and analyze qubit decoherence times by performing spin echo sequence. The two qubits in a double quantum dot are individually addressable due to different g-factors. The coupling between the qubits can be mediated by exchange interaction. The fidelities of single qubit rotations are sufficiently high to permit the implementation of two-qubit quantum gates such as controlled-not (C-NOT) or controlled-phase (C-Phase).

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