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Universal Set of Quantum Gates for Double-Dot Exchange-Only Spin Qubits Under Realistic Conditions MARCO DE MICHIELIS, ELENA FERRARO, DAVIDE ROTTA, GIOVANNI MAZZEO, MARCO TAGLIAFERRI, ALESSANDRO CRIPPA, MARCO FANCIULLI[1], Laboratorio MDM, IMM-CNR, Via Olivetti 2, I-20864 Agrate Brianza, Italy, ENRICO PRATI[2], IFN-CNR, P.zza L. da Vinci 32, I-20133 Milano, Italy — We report on a universal set of quantum logic gates for hybrid qubits. In a hybrid qubit the information is encoded in the spin state of three electrons elettrostatically confined in a silicon double quantum dot (QD), in (2,1) filling [1]. All electrical operations, reduced fabrication complexity and high scalability are the strengths of this technology. Schrieffer-Wolff effective models for both one [2] and two coupled hybrid qubit [3] are developed including the inescapable exchange interaction between electrons in the same QD. Optimal sequences of exchange interactions creating a complete set of quantum operations, namely Hadamard, $\pi/8$ and CNOT gates [4], are obtained by using a search algorithm, based on simplex and genetic ones. Silicon devices have been designed by SDFT-based program and efforts in its fabrication have produced in-plane inter-QDs distances down to 100 nm by means of electron beam lithography. Double QDs devices operating in few electron filling regime have been preliminary characterized at 4.2 K. Ref: [1] T.S. Koh et al., PRL 109, 250503 (2012) [2] E. Ferraro et al., quant-ph/arXiv, 1304.1800 (2013) [3] In preparation [4] M. De Michielis et al., submitted (2013)

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