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Fermionic Bell state analyzer for spin qubits HANS-ANDREAS ENGEL, Deparment of Physics, Harvard University, DANIEL LOSS, Department of Physics, University of Basel — In a seminal proposal Knill, Laflamme, and Milburn showed that quantum computation with photons is possible using only linear optics [1]. Partial measurements of a quantum state are sufficient and, most remarkably, coupling qubits with each other via gates is no longer required. It is an important task, therefore, to extend this concept to other qubit systems as well and, in particular, to search for physical realization of such partial measurements for Fermionic qubits. In an important step in this direction, Beenakker et al. recently proposed to combine partial Bell measurements of charge qubits with single qubit operations [2], however, no concrete read-out scheme was discussed. To address and solve this fundamental problem, we propose here to consider spin instead of charge, which is considered a promising candidate for a scalable qubit system [3]. We consider partial Bell state measurements on two spin qubits and argue that it can be performed with available techniques, based on spin-to-charge conversion and charge detection. This opens up the possibility to implement quantum computing without the need of two-qubit gates.

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