

Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Arbitrary error detection in a planar lattice of the surface code¹

ANTONIO CORCOLES, EASWAR MAGESAN, SRIKANTH SRINIVASAN, NICHOLAS BRONN, JARED HERTZBERG, ANDREW CROSS, MATTHIAS STEFFEN, JAY GAMBETTA, JERRY CHOW, IBM T J Watson Res Ctr — We detect arbitrary single-qubit errors on a system of four superconducting qubits arranged in a planar lattice, amenable to the surface code. The error detection protocol is based on the stabilizer formalism and protects a codeword encoded on an entangled two-qubit state by quantum non-demolition parity measurements, ZZ and XX . These parity measurements are performed using the other two qubits acting as syndromes. We introduce a bit- or phase-flip single-qubit error applied to the codeword and show that this error can be revealed uniquely in the syndromes. The -non-trivial-geometric arrangement of the qubits is essential to the surface code algorithm and is therefore extendable throughout the two-dimensional plane, encoding progressively larger logical Hilbert spaces towards a fully scaled fault-tolerant quantum computer.

¹We acknowledge support from IARPA under contract W911NF-10-1-0324

Antonio Corcoles
IBM T J Watson Res Ctr

Date submitted: 14 Nov 2014

Electronic form version 1.4