Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Logical qubit fusion[1] JONATHAN MOUSSA, Sandia National Laboratories, CIARAN RYAN-ANDERSON, Sandia National Laboratories, University of New Mexico — The canonical modern plan for universal quantum computation is a Clifford+T gate set implemented in a topological error-correcting code. This plan has the basic disparity that logical Clifford gates are natural for codes in two spatial dimensions while logical T gates are natural in three. Recent progress has reduced this disparity by proposing logical T gates in two dimensions with doubled [arXiv:1509.03239], stacked [PRA 93, 022323 (2016)], or gauge [PRA 93, 052332 (2016)] color codes, but these proposals lack an error threshold. An alternative universal gate set is Clifford+F [QIP 16, 1113 (2016)], where a fusion (F) gate converts two logical qubits into a logical qudit. We show that logical F gates can be constructed by identifying compatible pairs of qubit and qudit codes that stabilize the same logical subspace, much like the original Bravyi-Kitaev construction of magic state distillation. The simplest example of high-distance compatible codes results in a proposal that is very similar to the stacked color code with the key improvement of retaining an error threshold.

[1]Sandia National Labs is a multi-program laboratory managed and operated by Sandia Corp, a wholly owned subsidiary of Lockheed Martin Corp, for the U.S. Department of Energys National Nuclear Security Administration under contract DE-AC04-94AL85000.

Jonathan Moussa
Sandia National Laboratories

Date submitted: 10 Nov 2016 Electronic form version 1.4