Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Simulating a transmon implementation of the surface code, Part I[1] BRIAN TARASINSKI, THOMAS O'BRIEN, Instituut-Lorentz, Leiden University, Leiden, The Netherlands, ADRIAAN ROL, NIELS BULTINK, LEO DICARLO, QuTech and Kavli Institute of Nanoscience, Delft University of Technology, Delft, The Netherlands — Current experimental efforts aim to realize Surface-17, a distance-3 surface-code logical qubit, using transmon qubits in a circuit QED architecture. Following experimental proposals for this device, and currently achieved fidelities on physical qubits, we define a detailed error model that takes experimentally relevant error sources into account, such as amplitude and phase damping, imperfect gate pulses, and coherent errors due to low-frequency flux noise. Using the GPU-accelerated software package quantumsim, we simulate the density matrix evolution of the logical qubit under this error model. Combining the simulation results with a minimum-weight matching decoder, we obtain predictions for the error rate of the resulting logical qubit when used as a quantum memory, and estimate the contribution of different error sources to the logical error budget.

[1]Research funded by the Foundation for Fundamental Research on Matter (FOM), the Netherlands Organization for Scientific Research (NWO/OCW), IARPA, an ERC Synergy grant, the China Scholarship Council, and Intel Corporation.

Brian Tarasinski
Instituut-Lorentz, Leiden University, Leiden, The Netherlands

Date submitted: 11 Nov 2016 Electronic form version 1.4