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Error threshold for topological color codes on Union Jack lattices HELMUT G. KATZGRABER, Department of Physics, Texas A&M University & ETH Zurich, RUBEN S. ANDRIST, Department of Physics, ETH Zurich, HECTOR BOMBIN, Perimeter Institute for Theoretical Physics, MIGUEL ANGEL MARTIN-DELGADO, Departamento de Fisica, Universidad Complutense — Sensitivity to noise makes most of the current quantum computing schemes prone to error and nonscalable, allowing only for very small proof of principle devices. Topologicallyprotected quantum computing aimes to solve this problem by encoding quantum bits and gates in topological properties of the hardware medium that are immune to noise that does not impact the entire medium at once. There are different approaches to achieve topological protection. While traditional approaches use quasiparticle braidings, topological color codes use string-net condensates in 3-colexes. We study the error threshold of topological color codes on Union Jack lattices that allow for the implementation of the whole Clifford group of quantum gates. After mapping the error-correction process onto a statistical mechanical random 3-body Ising model on a Union Jack lattice, we compute its phase diagram in the temperature-disorder plane using Monte Carlo simulations. Our results show that topological color codes on Union Jack lattices have similar error stability than color codes on triangular lattices, as well as the Kitaev toric code.

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