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D-Colexes: Topological Computation and Brane-Net Condensates HECTOR BOMBIN, MIGUEL A. MARTIN-DELGADO, Departamento de Fisica Teorica I, Universidad Complutense de Madrid, Spain — Topological quantum order provides a way to reliably store quantum information. These systems show an energy gap and a topology dependent ground state degeneracy. Then one can use this degenerate subspace to protect quantum information from local interactions with the environment. Topological error correction codes are an interesting constructive approach towards topologically ordered systems. However, when one faces the issue of performing computations, not every topological code is suitable. We introduce a new family of topological codes that have such computational capabilities. They are constructed from certain D-dimensional lattices that we call D-colexes. For $D = 2$, they allow to perform any operation in the Clifford group without individually addressing the physical qubits that form the quantum memories. The point is that Clifford group operations are enough for many tasks in quantum information such as quantum distillation. In the $D = 3$ case even universal quantum computation is possible. From the perspective of topological order, the resulting systems give rise to interesting new topological orders: brane-net condensates.

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