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Topological order and topological memories at finite temperature
ALIOSCIA HAMMA, Perimeter Institute, CLAUDIO CASTELNOVO, University of Oxford, CLAUDIO CHAMON, Boston University — We discuss the notion of topological order and topological memories at finite temperature. We argue that topological order is given by a long range pattern of entanglement and relaxation times that scale with the size of the system. We obtain the behavior of topological entropy in 3D for the toric code and similar models, showing that half of it is completely washed out in the thermodynamic limit at any finite temperature. This corresponds to the fact that quantum memory is spoiled at any finite temperature and relaxation times are independent of the size of the system. We also study the possibility of obtaining long lived metastable states by confining defects by means of effective long ranged interactions. We discuss the implications for the existence of topological order and stable quantum memories at temperatures different from zero.

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