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Stability of Topological Quantum Phases at Zero Temperature SPYRIDON MICHALAKIS, Caltech, JUSTYNA PYTEL, Oregon State University — We prove stability of the spectral gap for gapped, frustration-free Hamiltonians under general, quasi-local perturbations. We present a necessary and sufficient condition for stability, which we call *Local Topological Quantum Order* and show that this condition implies an area law for the entanglement entropy of the groundstate subspace. This result extends previous work by Bravyi *et al*, on the stability of topological quantum order for the groundstate subspace of Hamiltonians composed of commuting projections with a common zero-energy subspace. Moreover, our result implies that zero-temperature topological order is robust against quasi-local perturbations, for all topologically ordered subspaces that correspond to the groundstate space of a gapped, frustration-free Hamiltonian. Finally, even in the absence of topological order, we show that symmetry-protected sectors are also stable against perturbations respecting the same symmetries.

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