Symmetry-protected adiabatic quantum transistors

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Adiabatic quantum transistors allow quantum logic gates to be performed by applying a large field to a quantum many-body system prepared in its ground state, without the need for local control. The basic operation of such a device can be viewed as driving a spin chain from a symmetry-protected phase to a trivial phase, and this perspective offers an avenue to generalise the adiabatic quantum transistor and to design several improvements. The performance of quantum logic gates is shown to depend only on universal symmetry properties of a symmetry-protected phase rather than fine tuned parent Hamiltonians, and it is possible to implement a universal set of logic gates in this way by combining several different types of symmetry protected matter. Such symmetry-protected adiabatic quantum transistors are argued to be robust to a range of relevant noise processes.

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[1] D. J. Williamson and S. D. Bartlett, arXiv preprint arXiv:1408.3415 (2014).