

Holonomic quantum computing in ground states of spin chains with symmetry-protected topological order

Mon, 2011-12-12 13:44 - [annette vogt](#) [1] **Date:** 2011-03-30

Author(s):

M. Renes, Akimasa Miyake, Gavin K. Brennen, and Stephen D. Bartlett

Reference:

arxiv:1103.5076

While solid-state devices offer naturally reliable hardware for modern classical computers, thus far quantum information processors resemble vacuum tube computers in being neither reliable nor scalable. Strongly correlated many body states stabilized in topologically ordered matter offer the possibility of naturally fault tolerant computing, but are both challenging to engineer and coherently control and cannot be easily adapted to different physical platforms. We propose an architecture which achieves some of the robustness properties of topological models but with a drastically simpler construction. Quantum information is stored in the degenerate ground states of spin-1 chains exhibiting symmetry-protected topological order (SPTO), while quantum gates are performed by adiabatic non-Abelian holonomies using only single-site fields and nearest-neighbor couplings. Gate operations respect the SPTO symmetry, inheriting some protection from noise and disorder from the SPTO robustness to local perturbation. A potential implementation using ultracold polar molecules trapped in optical lattices is described.

- [AQUTE](#) [2]
- [QIPC](#) [3]
- [01.20.+e Reversibility and irreversibility in information processing](#) [4]
- [Quantum Computation](#) [5]
- [Result](#) [6]
- [04.50.+m Efficient simulation of quantum many-body systems](#) [7]
- [14.50.+a Adiabatic quantum computation](#) [8]
- [14.60.+g Geometric/topological and holonomic quantum computation](#) [9]

Source URL:

<http://qurope.eu/db/publications/holonomic-quantum-computing-ground-states-spin-chains-symmetry-protected-topological>

Links:

[1] <http://qurope.eu/users/vogt>

[2] <http://qurope.eu/category/projects/ips/aqute>

[3] <http://qurope.eu/category/qipc/qipc>

[4] <http://qurope.eu/category/qics/00-quantum-information-science/01-physics-and-information-science/0120e-reversibility->

[5] <http://qurope.eu/category/virtual-institute/quantum-computation>

[6] <http://qurope.eu/category/attribute/result>

[7] <http://qurope.eu/category/qics/00-quantum-information-science/04-entanglement-many-body-systems/0450m-efficient-simul>

[8] <http://qurope.eu/category/qics/10-quantum-computation/14-models-and-architectures/1450a-adiabatic-quantum-computation>

[9] <http://qurope.eu/category/qics/10-quantum-computation/14-models-and-architectures/1460g-geometric-topological-and-holo>

