HARVARD UNIVERSITY
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Mathematical Picture Language Seminar

Tuesday, September 24

4:30 p.m. Boston time

Jefferson 356 and Zoom

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Solving the problem of preparing solvable anyons with constant-depth adaptive quantum circuits

Abstract: The classification of topological phases of quantum matter has recently been extended to allow constant-depth adaptive local quantum circuits. In this setting, a fundamental problem is the classification of topological phases that become equivalent to the trivial phase under adaptive quantum circuits. These are precisely the topological phases with ground states that can be prepared by constant-depth adaptive quantum circuits. In this work we establish such a classification in terms of solvable anyon theories, and argue that it is complete. Solvable anyon theories are a vast generalization of solvable groups that includes cyclic nonabelian anyons, and anyons with irrational quantum dimensions such as Ising anyons. We introduce a sequential gauging procedure that can produce a string-net ground state in any topological phase described by solvable anyons via a constant-depth adaptive local quantum circuit. We furthermore introduce a sequential ungauging and regauging procedure to implement string operators of arbitrary length for any solvable anyon theory via constant-depth adaptive local quantum circuits. Our general results are demonstrated for the quantum double of S_3 and for several examples that go beyond solvable groups including the doubled Ising theory, and the Drinfeld center of the Z_3 Tambara-Yamagami category.

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