LATTICE 2024

LIVERPOOL

Contribution ID: **243**   Type: **Talk**

Quantum Error Correction and Z(2) Lattice Gauge Theories

Monday 29 July 2024 11:35 (20 minutes)

A threshold probability in Quantum Error Correction (QEC) is maximally allowed quantum error rate below which QEC can be implemented for a given quantum code. Usually one can find a mapping of QEC problem into a statistical mechanics model under certain assumptions on the quantum error pattern in physical quantum circuits. Then this threshold probability can be studied by Monte Carlo simulation of mapped statistical mechanics model. Here, we show how this mappings work for toric/surface code in 2 dimension together with measurement errors with different assumptions and discuss results from Monte Carlo simulation of various classes of Z(2) lattice theories.

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Session Classification: Quantum computing and quantum information

Track Classification: Quantum Computing and Quantum Information