Contribution ID: **60** Type: **not specified**

Quantum Links for U(1) Gauge Theory on Qubits and Reduction to Z2 Gauge Theory and Toric Code

Wednesday, 5 August 2020 17:20 (20 minutes)

The quantum link Hamiltonian was introduced two decades ago as an alternative to Wilson's Euclidean lattice QCD with gauge fields represented by bi-linearfermion/anti-fermion operators, and later generalized as D-theory. Recasting as a Hamiltonian in Minkowski space for real time evolution, D-theory leads naturally to quantum algorithms. We investigate the simplest toy model of U(1) compact QED on triangular 2+1D lattice and construct gauge invariant kernels via the Suzuki-Trotter expansions which are realized as a quantum circuit capable of being tested on the Noisy Intermediate Scale Quantum (NISQ) devices. We demonstrate the performance of our algorithm on the existing hardware called IBM-Q with error mitigation. Furthermore, we also explore the similarity of our model to the Z2 gauge theory. Since its simplest example without dynamics, so-called toric code, can be leveraged as the quantum error correcting code, we may find a clue to an efficient scalable error correction/detection algorithm specifically for our model based on the relation between U(1) and Z2.

Primary author: KAWAI (*), Hiroki (Boston University)

Co-authors: BROWER, Richard C.; BERENSTEIN, David; COGBURN, Cameron V.

Presenter: KAWAI (*), Hiroki (Boston University)

Session Classification: Algorithms, machines, and code development

Track Classification: Algorithms, machines, and code development