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## Preparing Ground States for Quantum Computation of Gauge Theories

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Simulation of adiabatic methods on a quantum computer has been successfully used to prepare ground states of gauge theories. However, this process requires a high number of quantum gates, which is inaccessible in the NISQ era. An alternative approach is to use variational methods, which utilise a hybrid of classical and quantum computation. We show how a particular example, the Quantum Approximate Optimisation Algorithm (QAOA), can be used to prepare ground states of the Schwinger Model, with an improvement to circuit depth compared to the adiabatic approximation that targets current devices. In addition, we discuss how Permutational Quantum Computing can give us better optimisation beyond the NISQ era.

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