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Quantum Computing (2+1)-dimensional QED

We propose to utilize NISQ-era quantum devices to compute short distance quantities in (2 + 1)-dimensional QED and to combine them with large volume Monte Carlo simulations and perturbation theory. Since the theory is asymptotically free, it would serve as a training ground for future studies of Quantum Chromodynamics in (3 + 1)-dimensions on quantum computers. From the definition of the QED Hamiltonian on the lattice, we compute observables, e.g. the energy, with a Variational Quantum approach suitable also for excited energy levels. We explore methods for the encoding of the system efficiently on a quantum circuit and for the minimization procedure. In the latter case we examine techniques to combine operators and circuits, and test the performances of the optimizers available (in Qiskit). In particular, we perform a calculation of the mass gap in the small and intermediate regime, demonstrating, in the latter case, that it can be resolved reliably. The so obtained mass gap can be employed to match corresponding results from Monte Carlo simulations, which can be used eventually to find the lattice spacing and hence set the physical scale.

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Short summary of your poster content

Poster printing

Yes

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