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Leveraging quantum hardware for improved simulations of lattice field theories

Tuesday 25 March 2025 10:10 (20 minutes)

Simulating lattice field theories on quantum hardware presents significant challenges, particularly in state preparation and the efficient representation of mixed degrees of freedom. In this talk, I will discuss how quantum optimal control techniques can be used to mitigate barren plateaus in standard gate-based state preparation, enabling more efficient initialization of quantum states relevant for lattice models. Additionally, I will explore the potential of trapped ion quantum computers to simulate theories with both fermionic and bosonic degrees of freedom. Trapped ion platforms naturally support hybrid simulations that integrate bosonic and fermionic dynamics by utilizing collective ion modes to represent continuous variables and ion spins as qubits. This approach provides a powerful framework for advancing quantum simulations of lattice field theories beyond the capabilities of classical methods.

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