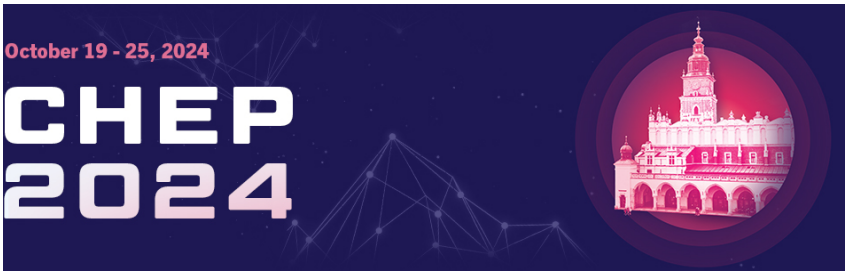

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Event generation with quantum computers through particle-oriented simulation

Wednesday 23 October 2024 14:24 (18 minutes)

Quantum computers may revolutionize event generation for collider physics by allowing calculation of scattering amplitudes from full quantum simulation of field theories. Although rapid progress is being made in understanding how best to encode quantum fields onto the states of quantum registers, most formulations are lattice-based and would require an impractically large number of qubits when applied to scattering events at colliders with a wide momentum dynamic range. In this regard, the single-particle digitization approach of Barata et al. (Phys. Rev. A 103) is highly attractive for its qubit efficiency and strong association with scattering. Since the original work established the digitization scheme on the scalar phi4 theory, we explore its extensions to fermion fields and other types of interactions. We then implement small-scale scattering simulations on both real quantum computers and a statevector calculator run on HPCs. A possible roadmap toward realizing the ultimate goal of performing collider event generation from quantum computers will be discussed.

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