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Towards quantum advantage in lattice gauge theory calculations (25+5)

Tuesday, January 14, 2025 9:30 AM (30 minutes)

Recent progress in quantum computing offers promising opportunities to address computational challenges in lattice gauge theories, particularly for real-time dynamics and scattering amplitudes that are inaccessible through classical methods like lattice QCD due to limitations such as the sign problem. This talk focuses on the use of measurement-based photonic quantum processors to calculate scattering observables in quantum field theories. The approach employs continuous-variable quantum information encoded in photonic qumodes, providing a scalable framework for simulating complex quantum systems with deterministic generation of exotic gates and fault-tolerant architectures. We will discuss methods for determining matrix elements of time-separated currents, which are essential for computing scattering amplitudes. By employing photonic quantum computing techniques, this work addresses critical challenges in simulating nonperturbative dynamics and real-time evolution of strongly interacting systems. These efforts represent an important step toward achieving quantum advantage in lattice gauge theory applied to nuclear and high-energy physics.

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