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Quantum Computing for Lattice Field Theory

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In this talk, we review recent advances in applying quantum computing to lattice field theory. Quantum technology offers the prospect to efficiently simulate sign-problem afflicted regimes in lattice field theory, such as the presence of topological terms, chemical potentials, and out-of-equilibrium dynamics. First proof-of-concept simulations of Abelian and non-Abelian gauge theories in (1+1)D and (2+1)D have been accomplished, and resource efficient formulations of gauge theories for quantum computations have been developed. The path towards quantum simulations of (3+1)-dimensional lattice gauge theories requires many incremental steps of improving both quantum hardware and quantum algorithms. After reviewing these requirements and recent advances, we discuss the main challenges and future directions.

Author: FUNCKE, Lena (University of Bonn)

Presenter: FUNCKE, Lena (University of Bonn)

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