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Digitization of Scalar Fields for NISQ-Era Quantum Computing

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With rapid developments in quantum hardware, it is increasingly important to analyze qubit, operator and gate requirements to optimally utilize available quantum resources for computation. In this talk, I present such an analysis for the digitization of interacting scalar field theories onto NISQ-era quantum devices, building upon the foundational work by Jordan, Lee and Preskill. Leveraging the Nyquist-Shannon sampling theorem (introduced in this context by Macridin, Spentzouris, Amundson and Harnik building on the work of Somma) as well as the Quantum Fourier Transform for digitization-improvement, a feasible number of qubits (< 10) can represent localized and delocalized low-energy wavefunctions with digitization errors below expected NISQ-era noise levels—naturally leading to the development of small-scale benchmarks for hardware implementations of scalar lattice field theory.

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