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Multi-scale quantum simulation of quantum field theory using wavelets

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Abstract

Most quantum algorithms for simulation of dynamics in real space use some version of bases which are localized in position and/or momentum and mapped into each other by Fourier transforms. While the quantum Fourier transform is efficient, more efficient evolutions may be possible for quantum states which are not localized in either basis. Wavelets are a versatile basis to represent functions which are neither localized in position nor momentum. In this talk, I will introduce wavelets and then discuss advantages of using wavelets in the context of quantum simulation algorithms for quantum field theories.