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Multiscale Methods in Quantum Field Theory

We use a basis of Daubechies scaling functions and wavelets to make an exact multi-resolution decomposition of a quantum field theories. The representation has natural resolution and volume truncations. We discuss the use of flow equation methods to decouple scales in volume and resolution truncations of the
theory. Using the example of a free scaler field theory, where different scales are coupled by derivatives in the Hamiltonian, we show that with a natural choice of flow generator that the flow equation evolves the truncated
Hamiltonian to a unitarily equivalent truncated Hamiltonian that is block diagonal on both resolution and energy.

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