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Spatio-temporal correlations after a quantum quench in the Bose-Hubbard model

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The Bose Hubbard model (BHM) is a minimal model that describes interacting ultracold bosons in an optical lattice, allowing the opportunity for experiments to probe quench dynamics of the model. Theoretically, it has proven challenging to study spatio-temporal correlations in the BHM in dimensions higher than one. We use the Schwinger-Keldysh technique and a strong-coupling expansion to develop a two-particle irreducible formalism that allows the study of spatio-temporal correlations in both the superfluid (SF) and Mott-insulating (MI) regimes during a quantum quench for dimensions higher than one. We obtain equations of motion for the superfluid order parameter and two-time correlation functions and present numerical results for the evolution of these functions. We relate our results to recent cold-atom experiments.

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