Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Nonequilibrium dynamics of the Bose-Hubbard model and the discrete nonlinear Schrdinger equation in one dimension CHRISTIAN B. MENDL, Stanford Univ, JOHANNES M. OBERREUTER, MICHAEL KNAP, HERBERT SPOHN, Technical University of Munich — We study finite temperature time correlations of the Bose-Hubbard model and its classical analogue, the discrete nonlinear Schrdinger (DNLS) equation, on a one-dimensional lattice. In the high temperature regime the DNLS exhibits diffusive spreading of the density and energy correlations. With lowering temperature, Umklapp processes become rare, such that phase differences appear as an additional (almost) conserved field. Using nonlinear fluctuating hydrodynamics as theoretical framework, we establish that the DNLS time correlations have the same signature as a generic anharmonic chain, in particular Kardar-Parisi-Zhang (KPZ) broadening for the sound peaks and Lvy 5/3 broadening for the heat peak. These theoretical predictions agree well with numerical simulations of the DNLS. In the, so far not sharply defined, ultra-low temperature regime the integrability of the dynamics becomes visible. Finally, we investigate how these results can be transcribed to quantum systems by comparing with numerical simulations of the Bose-Hubbard model, using time-dependent density matrix renormalization group schemes at finite temperature.

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Date submitted: 11 Nov 2016 Electronic form version 1.4