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Small Quench Dynamics as an Investigative Tool for Cold Atom Systems SUNIL YESHWANTH, University of Southern California, MARCOS RIGOL, Pennsylvania State University, LORENZO CAMPOS VENUTI, University of Southern California — Finite one-dimensional systems of bosons or fermions described by the Hubbard model can be realized using cold atoms confined in an optical lattice. The ground states of these systems are often characterized by a coexistence of phases when a non-homogeneous trapping potential is applied. We propose to analyze this phase coexistence by studying the out-of-equlibrium dynamics following a sudden quench. In particular we show that the temporal variance of the local densities is able to spot the boundaries between the different phases. The feasibility of this approach is demonstrated for several Hamiltonians using numerical simulations. We first consider an integrable system, hardcore bosons confined by quadratic or quartic trapping potentials, where Mott and superfluid phases are coexistent. We also analyze a non-integrable system, a $t - VV'$ model which has a charge density wave phase coexisting with a superfluid one when subjected to a quadratic confining potential. We find that the temporal variance is more effective than other standard indicators of phase boundaries such as the local compressibility or density fluctuations.

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