Finite-temperature dynamical structure factor of the one-dimensional Bose gas: From the Gross-Pitaevskii equation to the Kardar-Parisi-Zhang universality class of dynamical critical phenomena

AUSTEN LAMACRAFT, University of Cambridge, MANAS KULKARNI, Princeton University — We study the finite-temperature dynamical structure factor $S(k,\omega)$ of a one-dimensional Bose gas using numerical simulations of the Gross-Pitaevskii equation appropriate to a weakly interacting system. The line shape of the phonon peaks in $S(k,\omega)$ has a width proportional to $|k|^{3/2}$ at low wave vectors. This anomalous width arises from resonant three-phonon interactions, and reveals a remarkable connection to the Kardar-Parisi-Zhang universality class of dynamical critical phenomena.