Physical Review E, vol.106, no.2, pp.024802-1-024802-9, August, 2022.

Anomalous ballistic scaling in the tensionless or inviscid Kardar-Parisi-Zhang equation

E. Rodríguez Fernández; S.N. Santalla Arribas; M. Castro Ponce; R. Cuerno Rejado

Abstract-

The one-dimensional Kardar-Parisi-Zhang (KPZ) equation is becoming an overarching paradigm for the scaling of nonequilibrium, spatially extended, classical and quantum systems with strong correlations. Recent analytical solutions have uncovered a rich structure regarding its scaling exponents and fluctuation statistics. However, the zero surface tension or zero viscosity case eludes such analytical solutions and has remained ill-understood. Using numerical simulations, we elucidate a well-defined universality class for this case that differs from that of the viscous case, featuring intrinsically anomalous kinetic roughening (despite previous expectations for systems with local interactions and time-dependent noise) and ballistic dynamics. The latter may be relevant to recent quantum spin chain experiments which measure KPZ and ballistic relaxation under different conditions. We identify the ensuing set of scaling exponents in previous discrete interface growth models related with isotropic percolation, and show it to describe the fluctuations of additional continuum systems related with the noisy Korteweg–de Vries equation. Along this process, we additionally elucidate the universality class of the related inviscid stochastic Burgers equation.

Index Terms- physics, mathematical models, simulation.

Citation:
Rodríguez-Fernández, E.; Santalla, S.N.; Castro, M.; Cuerno, R. "Anomalous ballistic scaling in the tensionless or inviscid Kardar-Parisi-Zhang equation", Physical Review E, vol.106, no.2, pp.024802-1-024802-9, August, 2022.