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Anomalous dynamic scaling of Ising interfaces

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Abstract-

Until very recently, the asymptotic occurrence of intrinsic anomalous scaling has been expected to require concomitant effects for kinetically rough interfaces, like quenched disorder or morphological instabilities. However, counterexamples have been recently reported for simpler situations dominated by time-dependent noise, as in the discrete growth system associated with an Ising model proposed by Dashti-Naserabadi et al (2019 Phys. Rev. E 100, 060101(R)), who assessed the equilibrium behaviour of the model. Here, we revisit this system to characterise its time-dependent behaviour in two and three dimensions (one- and two-dimensional interfaces, respectively). While the 3D case seems dominated by a fast evolution beyond critical dynamics, in the 2D case, numerical simulations of an associated time-dependent Ginzburg–Landau equation retrieve the same static (roughness) exponents and the same intrinsic anomalous scaling ansatz as in the equilibrium case throughout the complete time evolution. However, the dynamic exponent is seen to cross over between two different values, none of which enables identification with previously known universality classes of kinetic roughening. Moreover, simulations for larger system sizes suggest a breakdown of scaling behaviour at the largest scales, suggesting that the previously reported scaling behaviour may be effective and restricted to relatively small systems.

Index Terms- mathematical modeling, theoretical immunology, stochastic processes

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