Critical dynamics of reaction-diffusion fronts

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We have studied the dynamical critical behavior of the reversible process

$$A + A \longleftrightarrow A, \tag{1}$$

whose macroscopic dynamics is described by the Fisher equation [1, 2, 3],

$$\partial_t \rho = D\nabla^2 \rho + k_1 \rho - k_2 \rho^2, \tag{2}$$

where $\rho(\mathbf{r}, t)$ is the local concentration field.

We have revisited this discrete model in two dimensions, performing extensive numerical simulations of the time evolution of the interface separating the stable and unstable phases. In particular, we have measured the critical exponents which characterize the spatio-temporal fluctuations of such front for different lattice sizes. These exponents are in very good agreement with those computed in Ref. [4], and are determined by the Kardar-Parisi-Zhang (KPZ) universality class for one-dimensional interfaces.

Furthermore, we have studied the statistics of rescaled front fluctuations, which had remained thus far unexplored in the literature and allows for a further stringent test of KPZ universality [5, 6].

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