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Kinetic roughening phenomena, stochastic growth, directed polymers and all that. Aspects of multidisciplinary statistical mechanics

Timothy Halpin-Healy [a, b] ... Yi-Cheng Zhang [c]

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Abstract

Kinetic interfaces form the basis of a fascinating, interdisciplinary branch of statistical mechanics. Diverse stochastic growth processes can be unified via an intriguing nonlinear stochastic partial differential equation whose consequences and generalizations have mobilized a sizeable community of physicists concerned with a statistical description of kinetically roughened surfaces. Substantial analytical, experimental and numerical effort has already been expended. Despite impressive successes, however, there remain many open questions, with much richness and subtlety still to be revealed. In this review, we give an unorthodox account of this rapidly growing field, concentrating on two main lines

â€˝ the interface growth equations themselves, and their directed polymer counterparts. We emphasize the intrinsic links among the topics discussed, as well as the relationships to other branches of natural science. Our aim is to persuade the reader that multidisciplinary statistical mechanics can be challenging, enjoyable pursuit of surprising depth.

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