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Attractors in one-dimensional spatiotemporal chaos

We discuss the dynamics on the attractor of a family of one-dimensional PDEs displaying spatiotemporally chaotic solutions, including the Kuramoto–Sivashinsky (KS) equation. We obtain bounds and estimates on the L^2 norm and attractor dimension. A sixth-order analogue of the KS equation, the Nikolaevskii model for short-wave pattern formation with Galilean invariance, displays a novel multiple-scale attractor. We show that existing modulation equation descriptions coupling the amplitudes for the patterned mode and mean flow, while asymptotically consistent, are incomplete. The attractor features spatiotemporal chaos with strong scale separation, coexistence of scaling regimes, anomalous exponents and Burgers-like viscous shocks. These are captured by higher-order corrections to the amplitude equations.