

Sharp interface dynamics in presence of large scale linear fields

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Nonlinear spatially extended systems often feature co-existing stable states combined with a multi-scale nature. This leads to sharp interfaces separating regions of different dominating states. Examples include multi-population systems, chemical reactors, models for gas discharge and more abstractly generalized phase field models.

We consider the Allen-Cahn equation in 1D coupled with large scale linear fields, and discuss how a single interface gains non-trivial self-organised dynamics. This ranges from direction changing, to oscillatory and chaotic motion. We show how this can be rigorously understood by a combination of geometric singular perturbation theory, functional analysis, and center manifold reduction.

This is joint work with Martina Chirilus-Bruckner (Leiden) and Peter van Heijster (Wageningen).