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Fluctuation-driven Turing patterns in predator-prey dynamics

THOMAS BUTLER, Massachusetts Institute of Technology, NIGEL GOLDENFELD, University of Illinois at Urbana-Champaign — Models of diffusion-driven pattern formation that rely on the Turing mechanism are utilized in many areas of science. However, many such models suffer from the defect of requiring fine tuning of parameters or an unrealistic separation of scales in the diffusivities of the constituents of the system in order to predict the formation of spatial patterns. In the context of a generic model of predator-prey population dynamics, we show that the inclusion of intrinsic noise in Turing models leads to the formation of "quasipatterns" that form in generic regions of parameter space and are experimentally distinguishable from standard Turing patterns. The existence of quasipatterns removes the need for unphysical fine tuning or separation of scales in the application of Turing models to real systems. We also exhibit numerical simulations of the formation of quasi-patterns deep in the quasi-pattern phase.

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