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Emergence of hyper-hexagonal patterns in orientation map models of reduced rotation symmetry WOLFGANG KEIL, MICHAEL SCHNABEL, FRED WOLF, BCCN and MPIDS, Goettingen, Germany — Neurons in the primary visual cortex preferentially respond to visual stimuli of a particular orientation. These orientation preferences are arranged in aperiodic 2-D patterns, known as orientation preference maps (OPMs). Symmetry assumptions have been used successfully to derive a class of theoretical model which accounts for the emergence of aperiodic pinwheel-rich OPMs. Measurements revealed anisotropic coupling statistics in the underlying neural tissue, suggesting that the symmetry of models for the formation of orientation maps is reduced from the previously assumed E(2)xO(2) to E(2). In dynamical models for OPMs with E(2)xO(2) symmetry interactions represented by quadratic terms cannot occur but may be present in models of reduced E(2) symmetry. Here, we present a general analysis of the impact of such interactions on the formation of OPMs. We demonstrate that near the onset of pattern formation only two basic types of quadratic interaction terms exist, introduce a general parametric representation of permissible quadratic interactions near pattern formation onset, and derive the most general amplitude equations describing pattern selection in models incorporating quadratic interactions. We study the impact of such interactions on the spatial structure of OPMs, by incorporating them into a Swift-Hohenberg-model of OPM formation.

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