Boundary Effects in Stochastic Cyclic Competition Models on a Two-Dimensional Lattice

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We study noise-induced and -stabilized spatial patterns in two distinct stochastic population model variants for cyclic competition of three species, namely the Rock-Paper-Scissors (RPS) and the May-Leonard (ML) models. In two dimensions, it is well established that the ML model can display (quasi-)stable spiral structures, in contrast to simple species clustering in the RPS system. Our ultimate goal is to develop local control schemes which allow us to affect the formation of these spatio-temporal patterns. To this end, we have employed MC simulations to investigate how changing the microscopic rules in a subsection of a two-dimensional lattice influences the macroscopic behavior in the rest of the lattice. Specifically, we implement the ML reaction scheme on a torus, except on a ring-shaped patch, which is set to follow the cyclic Lotka-Volterra predation rules of the RPS model. At the RPS-ML interface we observe a marked disruption of the usual spiral patterns in the form of plane waves emanating from the RPS region. Also, we report a distinct decrease in local population density near the interface in comparison to the bulk of the ML region.

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