

On the selective advantage of diffusing faster

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We present a stochastic spatial model of biological competition in which two species have the same birth and death rates, but differ in their diffusion constants. We show that even a relative difference in diffusivity on the order of a few percent may lead to a strong bias in the coarsening process favoring the more agile species. We quantify this selective advantage theoretically and present analytical formulas for the average growth of the fastest species and its fixation probability. Finally, we show that advection by an incompressible flow does not alter our result, provided the turbulent scale is sufficiently large.

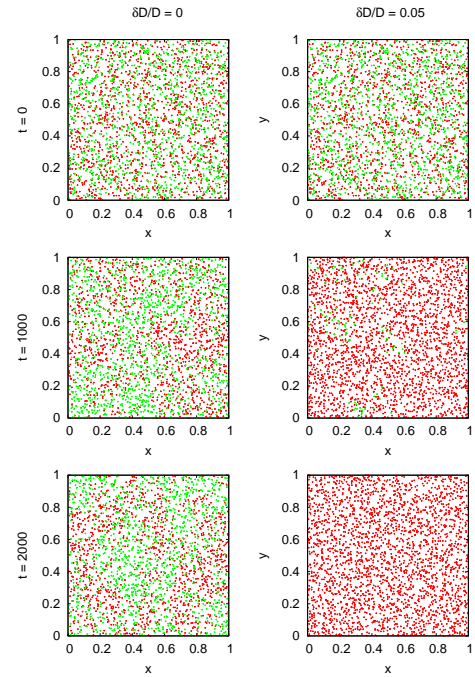


FIG. 1. Snapshots of $2d$ configurations of the particle model at different times. In all panels, parameters are $N = 10^4$ and $D = 10^{-4}$. In the simulation of the left column, the two species have the same diffusivity, while in the right column the red species has diffusivity $D + \delta D$ with $\delta D/D = 0.05$. To help the viewer, configurations has been downsampled (one every four particles, chosen at random, are shown).

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¹ S. Pigolotti and R. Benzi, submitted (arXiv:1307.8252).