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Flow-driven Delocalization of Populations with Heterogeneous Growth Rates THIPARAT CHOTIBUT, DAVID NELSON, Harvard University, SAURO SUCCI, Istituto per le Applicazioni del Calcolo, and Harvard University — Growth in controlled laboratory environments such as a Petri dish can be used to study the spatial evolutionary dynamics of microorganisms. However, natural populations often grow up in heterogeneous environments with spatially varying growth rates, and can be subjected to fluid advection as well. Using lattice Boltzmann simulations, we study single species population dynamics subject to constant flows under heterogeneous growth conditions. We show that quenched random growth rates lead to localized growth niches even in the presence of a background fluid flow. Non-equilibrium steady states when the flow velocity is weak exhibit a mixture of localized high-density growth niches and a low-density background mass distribution influenced by extended states of the linearized growth operator. At sufficiently strong advection, however, the growth niches suddenly delocalize to form elongated parallel streaks of order the system size along the flow direction. We discuss the localized and delocalized growth eigenfunctions, as well as a phase transition characterized by a diverging correlation length in the flow direction.

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