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Phase separation in fluids with chaotic advection DANIEL BELLER, Brandeis University, BEN VOLLMAYR-LEE, SOHEI YASUDA, Bucknell University — When immiscible fluids are advected by an externally applied chaotic flow field, a nonequilibrium steady state arises from the competition between coarsening and the chaotic ripping-apart of domains. We simulate a two-dimensional binary fluid system advected by two different flow fields: a periodic alternating vortex flow and a periodic alternating sine flow. For each case, we examine the local degree of chaos in the flow field by computing finite-backward-time Lyapunov exponent values at each point in the system. We find that this Lyapunov exponent field is correlated with the advected fluids' local free energy density, which is inversely related to the local time-averaged size of phase-separated domains in the steady state. This raises the possibility of making universal predictions of steady-state characteristics based on Lyapunov analysis of the flow field.

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