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Convective and Diffusive Instabilities in Phase Separation Subjected to a Temperature Ramp

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Inducing phase separation by a sustained change of temperature induces convection and repeated waves of nucleation. They are due to an interplay of the well-known convective nonlinearity and the nonlinearity in the diffusion, which is also responsible for spinodal decomposition. The boundary of stability towards the onset of nucleation can be found analytically. The onset of convection can be described based on a Galerkin expansion. However, typical technological applications lie well beyond *both* boundaries. We also suggest a minimal theoretical model for oscillatory demixing in this regime, where the oscillations appear to be of thermodynamic origin. In accordance with experiments we predict that their frequency depends on the diffusion constant and ramp rate, and is not affected by the overall composition and sample geometry.