

Seminar/Talk

Nucleation beyond Equilibrium: Fronts Control Invasion in Bistable Ecosystems

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Host: Jérémie Palacci

Drop a patch of one microbial strain into a lawn of a competitor: below a critical size it dies out, above it takes over. Physicists recognise this as nucleation, and know how to compute the invasion probability from an energy landscape. But ecosystems have no energy landscape, and their state is not a single field but several coupled, non-conserved abundances.In this talk I will show that one can nevertheless build a nucleation theory for such systems. I will derive it for reaction-diffusion dynamics, and show that the mathematical structure of Classical Nucleation Theory survives arbitrarily far from equilibrium, provided energetic quantities are replaced by dynamical properties of propagating fronts: the front speed takes over the role of the bulk free-energy difference, and the diffusivity that of the surface tension. I will test these predictions against direct numerical simulations.Applying the theory to two competing Lotka-Volterra species, I will show that strong antagonism opens a depletion region inside fronts, invisible to any scalar description, which makes invasion exponentially harder at fixed competitive advantage, a prediction testable in microbial experiments.

Thursday, December 17, 2026 11:00am - 12:00pm
Moonstone Bldg / Ground floor / Seminar Room F (I24.EG.030f)

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