# Critical regimes driven by recurrent mobility patterns of reaction-diffusion processes in networks

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Reaction-diffusion processes have been widely used to study dynamical processes in epidemics and ecology in networked metapopulations. In the context of epidemics, reaction processes are understood as contagions within each subpopulation (patch), while diffusion represents the mobility of individuals between patches. Recently, the characteristics of human mobility, such as its recurrent nature, have been proven crucial to understand the phase transition to endemic epidemic states.

Here, by developing a framework able to cope with the elementary epidemic processes, the spatial distribution of populations and the commuting mobility patterns, we discover three different critical regimes of the epidemic incidence as a function of these parameters. Interestingly, we reveal a regime of the reaction-diffussion process in which, counterintuitively, mobility is detrimental to the spread of disease.

We analytically determine the precise conditions for the emergence of any of the three possible critical regimes in real and synthetic networks.