# Effects of diffusion in contact processes with distinct interactions and discontinuous transitions

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Several studies have shown that diffusion can be a relevant perturbation, affecting drastically the critical behavior or even leading to distinct scenarios for discontinuous phase transitions in contact processes. With these ideas in mind, we have studied the influence of diffusion for two bidimensional contact processes. In the first model, the interaction between first neighbors requires a minimal neighborhood of adjacent particles for creating new offspring, whereas second neighbors interact as usual (e.g. at least one neighboring particle is required). The second model takes the opposite situation, in which the restrictive dynamics is in the interaction between next-nearest neighbors sites. An unusual asymmetric active phase, in which the system sublattices are unequally populated, and the presence of reentrant transition lines are observed. Besides, discontinuous phase transitions (even between the active phases) and tricritical points emerge.

An important question to be investigated is if local diffusion changes the nature of the transitions, specially the discontinuous ones. Results from mean field theory and Monte Carlo simulations reveal that low diffusion rates do not destroy the sublattice ordering, ensuring the maintenance of the asymmetric phase. On the other hand, for diffusion rates larger than a threshold value $D_C$ the sublattice ordering is suppressed and only the usual inactive-symmetric transition is present. The critical behavior and universality classes are not affected by the diffusion. The discontinuous absorbent-asymmetric phase transitions are destroyed by diffusion. Finally, the first-order asymmetric-symmetric transitions are destroyed by diffusion and they become continuous before be suppressed.

## Type

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