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Disordered contact process in two and three dimensions: rare regions, Griffiths effects, and infinite randomness ADAM FARQUHAR, JASON MAST, THOMAS VOJTA, University of Missouri-Rolla — We investigate the effects of quenched spatial disorder on the directed percolation universality class in two and three space dimensions. To this end we perform large-scale Monte-Carlo simulations of the contact process on a randomly diluted lattice for times up to 10^{10} and system sizes up to 6×10^7 sites. We study both the nonequilibrium phase transition and the associated Griffiths region between the clean and disordered critical points. Rare strongly coupled regions lead to slow dynamics characterized by a nonuniversal power-law density decay in the entire Griffith region. In two dimensions, we also perform a detailed scaling analysis of the critical behavior right at the phase transition. We find an infinite-randomness critical point with activated rather than power-law dynamical scaling. However, the critical region is narrow and the approach to the asymptotic dynamics is extremely slow, which hampers the precision of our critical exponent estimates. We discuss the generality of our findings and relate them to a broader theory of rare region effects at phase transitions with quenched disorder.

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