

Persistence of crossings in dynamical planar percolation

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In the $n \times n$ rhombus on the triangular lattice, let each vertex switch between open and closed according to iid Poisson clocks of rate 1. At any moment, this is critical site percolation, with the probability of a left-right open crossing being exactly $1/2$. The existence of a crossing is extremely noise-sensitive: in the dynamics, it decorrelates on a time scale $\rho(n) = n^{-3/4+o(1)}$, which is much shorter than the constant relaxation time of the entire system.

What is the probability that a crossing exists continually for time $t\rho(n)$, large t ? Hammond-Pete-Mossel (2012) proved that this is at least exponential, but decays faster than any polynomial in t . My current joint work with Malo Hillairet gives a lower bound $\exp(-t^{2/3+o(1)})$, which might actually be the true behaviour. The proof makes sense of a naive renormalization heuristic proposed 15 years ago.