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Mixing times of critical Potts models

We will discuss recent progress, jointly with R. Gheissari, on the dynamical phase transition for the critical q -state Potts model on the 2D torus (both single-site dynamics such as Glauber/Metropolis and cluster dynamics such as Swendsen-Wang), where the conjectured behavior was a mixing time that is polynomial in the side-length for $q = 2, 3, 4$ colors but exponential in it for $q > 4$. We will compare these results with the behavior on the complete graph on n vertices at criticality, sketching a proof from recent work with R. Gheissari and Y. Peres that, in that setting, Swendsen-Wang dynamics is exponentially slow in n .