

# Dynamics for the mean-field random-cluster model

Antonio Blanca, U.C. Berkeley

## Abstract

The random-cluster model has been widely studied as a unifying framework for random graphs, spin systems and random spanning trees, but its dynamics have so far largely resisted analysis.

In this work we study a natural non-local Markov chain known as the Chayes-Machta dynamics for the mean-field case of the random-cluster model, and identify a critical regime  $(\lambda_s, \lambda_S)$  of the model parameter  $\lambda$  in which the dynamics undergoes an exponential slowdown. Namely, we prove that the mixing time is  $\Theta(\log n)$  if  $\lambda \notin [\lambda_s, \lambda_S]$ , and  $\exp(\Omega(\sqrt{n}))$  when  $\lambda \in (\lambda_s, \lambda_S)$ . These results hold for all values of the second model parameter  $q > 1$ . In addition, we prove that the local heat-bath dynamics undergoes a similar exponential slowdown in  $(\lambda_s, \lambda_S)$ .

Joint work with Alistair Sinclair.