Universality of cutoff for graphs with a random matching

Abstract:

(Joint work with Perla Soui and Allan Sly.) A sequence of Markov chains is said to exhibit cutoff if it exhibits an abrupt convergence to equilibrium. Loosely speaking, this means that the epsilon mixing time (i.e. the first time the worst-case total-variation distance from equilibrium is at most epsilon) is asymptotically independent of epsilon. An emerging paradigm is that cutoff is related to entropic concentration. In the case of random walks on random graphs G=(V,E), the entropic time can be defined as the time at which the entropy of random walk on some auxiliary graph (often the Benjamini-Schramm limit) is log |V|. Previous works established cutoff at the entropic time in the case of the configuration model. We consider a random graph model in which a random graph G'=(V,E') is obtained from a given graph G=(V,E) by picking a random perfect matching of the vertices, and adding an edge between each pair of matched vertices. We prove cutoff at the entropic time, provided G is of bounded degree and its connected components are of size at least 3. Previous works were restricted to the case that the random graph is locally tree-like.

We also consider the case that the added edges from the perfect matching have a weight epsilon < 1 which may depend on |V| and in many cases we determine for which range of values of epsilon there is cutoff.