Mixing and relaxation time for random walk on wreath product graphs

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Suppose that G and H are finite, connected graphs, X is a lazy random walk on G and Z is a reversible Markov chain on H. The lamplighter chain Y^E associated with X and Z is the random walk on the wreath product $H \wr G$, the graph whose vertices consist of pairs (f; x) where f is a labeling of the vertices of G by elements of H and x is a vertex in G. In each step, Y^E moves from a configuration (f; x) by updating x to y using the transition rule of X and then updating both f(x) and f(y) according to the transition probabilities on H; f(z) for z unequal x or y remains unchanged.

We give (up to constant factor) matching upper and lower bounds on the mixing and relaxation time of the lamplighter chain when the size of the graph sequence under consideration tends to infinity, i.e. the size of the lamp graph may grow together with the base as well. A critical ingredient for our proof is the relation between strong stationary times and separation distance.