TYPE TRANSITION FOR RANDOM WALKS ON INHOMOGENEOUS SEMI-GROUPOIDS

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We review known results on the type of random walks on graphs associated with inhomogeneous groupoids or semi-groupoids. Such graphs constitute a natural and non-trivial generalisation of random walks on Cayley graphs on groups and have numerous potential applications straddling very diverse fields ranging from the propagation of information on communication networks to the discretisation of the notion of causality in quantum gravity and passing through Penrose tilings. We shall concentrate on some recent results, concerning simple random walks on a partially directed version ofthe integer square lattice. More precisely, vertical edges between neighbouring vertices can be traversed in both directions (they are undirected) while horizontal edges are one-way. The horizontal orientation is prescribed by a random perturbation of a periodic function, the perturbation probability decays according to a power law in the absolute value of the ordinate. We show that there exists a critical value of the decay power above which the walk is almost surely recurrent and below which is almost surely transient.