A pointwise ergodic theorem for quasi-pmp graphs

Abstract:
We prove a pointwise ergodic theorem for locally countable ergodic quasi-pmp (nonsingular) graphs, which gives an increasing sequence of Borel subgraphs with finite connected components, averages over which converge a.e. to the expectations of $L^1$-functions. This can be viewed as a random analogue of pointwise ergodic theorems for group actions: instead of taking a (deterministic) sequence of subsets of the group and using it at every point to compute the averages, we allow every point to coherently choose such a sequence at random with a strong condition that the sets in the sequence determine a connected subgraph of the Schreier graph of the action.

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