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"Fast multilevel numerical methods for random walks on directed graphs"

This talk is about numerical methods that combat slow mixing in Markov chains by a multilevel aggregation approach.

We first discuss multilevel aggregation methods for calculating the stationary vector of large, sparse and irreducible Markov chains, for example, the chains induced by random walks on directed graphs. When the Markov chain is slowly mixing, traditional iterative methods like the power method converge very slowly. Convergence can be accelerated by recursively aggregating states and iterating on increasingly coarse versions of the Markov chain. It will be explained heuristically why it is advantageous to use overlapping aggregates, and numerical results show that convergence can be obtained in close to linear time for some classes of Markov chains. We will conclude the talk by briefly explaining how similar multilevel aggregation strategies can also be used to speed up Markov chain Monte Carlo simulations of spin systems.