Approximating metastable continuous-space Markov chains by Markov chains on a finite set

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We are interested in discrete-time, continuous-space Markov chains, admitting N metastable states. Our main motivation comes from the notion of random Poincaré maps, which describe stochastic perturbation of differential equations admitting several periodic orbits. We show that under quite general assumptions, these Markov chains admit exactly N eigenvalues exponentially close to 1, separated from the rest of the spectrum by a spectral gap. Our main result is that the behaviour of the system can be approximated, uniformly in time, by a Markov chain with N states, defined in terms of suitably defined quasistationary distributions.

Partly based on joint work with Manon Baudel.