Moment asymptotics for branching random walks in random environment

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We consider the long-time behaviour of a branching random walk in random environment on the d-dimensional lattice. The migration of particles proceeds according to simple random walk in continuous time, while the medium is given as a random potential of spatially dependent killing/branching rates. The main objects of our interest are the annealed moments $\langle m_n^p(t,0)\rangle$, i.e., the p-th moments over the medium of the n-th moment over the migration and killing/branching, of the population size at time t. For $n = 1$, this is well-understood, as m_1 is closely connected with the parabolic Anderson model. For some special distribution, Albeverio *et al* (2000) extended this to $n \geq 2$, but only as to the first term of the asymptotics, using (a recursive version of) a Feynman-Kac formula for $m_n(t,0)$.

We derive also the second term of the asymptotics, for a much larger class of distributions. In particular, we show that $\langle m_n^p\rangle$ and $\langle m_1^{np}\rangle$ are asymptotically equal, up to an error $E^{o(t)}$. The cornerstone of our method is a direct Feynman-Kac-type formula for $m_n(t,0)$, which we establish using the spine techniques developed recently by Harris and Roberts.

(joint work with Gün and Sekulovic (Berlin).)