Limit theorems for additive functionals of continuous-time random walk

Georgiy Shevchenko

Taras Shevchenko National University of Kyiv

We study a continuous-time random walk (CTRW) $X = \{X_t, t \geq 0\}$, whose evolution is described by an iid sequence of times between consecutive jumps θ_n, $n \geq 1$, and by a iid sequence of centered jumps ξ_n, $n \geq 1$; the two sequences are assumed to be independent. The times between jumps θ_n are assumed to be integrable, but not necessarily having exponential distribution, so CTRW is in general not a Markov process.

For a function $f \colon \mathbb{R} \to \mathbb{R}$, we are interested in asymptotic behavior, as $n \to \infty$, of the normalized additive functional $c_n \int_0^{nt} f(X_s)ds$, $t \geq 0$. Similarly to the Markov situation, assuming that the jumps ξ_n belong to the domain of attraction of α-stable law with $\alpha > 1$, we establish the convergence to the local time at zero of an α-stable Lévy motion.

We further study a situation where X is delayed by a random environment given by the Poisson shot-noise potential: $\Lambda(x,\gamma) = e^{-\sum_{y\in\gamma}\phi(x-y)}$, where $\phi \colon \mathbb{R} \to [0,\infty)$ is a bounded function decaying sufficiently fast, and γ is a homogeneous Poisson point process, independent of X. It turns out that in this case the asymptotics has both "quenched" component depending on Λ, and a component, where Λ is "averaged".

The talk is based on joint research with Yuliya Mishura (University of Kyiv) and Yuri Kondratiev (Bielefeld University).

e-mail: zhora@univ.kiev.ua