Confined Lévy Flights and Related Topics

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Abstract

I consider three models of the "Lévy-like" random processes, which possess finite variance in contrast with free Lévy flights (LFs), and therefore called "tame" LFs, namely,
(i) confined LFs, i.e., LFs in external non-linear potential fields;
(ii) damped LFs, i.e., LFs in stochastic systems with non-linear friction;
and
(iii) power law truncated LFs.
In particular, I discuss the following properties of tame LFs:
- non-Boltzmann stationarities,
- steep power-law asymptotics of the probability densities,
- bifurcations during relaxation,
- Kramers' problem for LFs,
and
- evolution of the probability density function from the Lévy stable law towards the Gaussian law.
These properties are discussed with the use of analytical and numerical solutions of fractional kinetic equations as well as numerical simulation based on the Langevin equation.