

# Burning Questions on Levy Flights

Ralf Metzler, Joseph Klafter and Aleksei Chechkin

*Nordic Institute for Theoretical Physics  
Denmark*

Levy flight phenomena have been studied in literature for decades. Their Markovian nature, in contrast to subdiffusive or spatiotemporally coupled Levy walk processes, makes them mathematically rather straightforward objects to investigate. Surprisingly though, a number of fundamental questions on the particular behaviour of Levy flights have only very recently been addressed. The talk will start from a search picture involving unbiased Levy flights, where the Levy exponent can be derived explicitly. This problem prompts the question of the first passage and first arrival behaviours of Levy flights, that are analyzed analytically and numerically. It will then be shown that the index of the Levy process is not changed in an harmonic external potential, contrasted by steeper than harmonic potentials leading to finite variance and thus a stationary solution that is no longer Levy stable, and a multimodal structure of the propagator. This result will then be used to discuss the physicality of the diverging kinetic energy problem of Levy dynamics. Finally, the barrier crossing of a process subject to Levy stable noise is addressed.