Statistical Physics and Anomalous Dynamics of Foraging

Rainer Klages

Technische Universität Berlin, Institut für Theoretische Physik

Queen Mary University of London, School of Mathematical Sciences

A question that attracted a lot of attention in the past two decades is whether biologically relevant search strategies can be identified by statistical data analysis and mathematical modeling [1,2]. A famous paradigm in this field is the *Lévy Flight Foraging Hypothesis*. It states that under certain mathematical conditions Lévy dynamics, which defines a key concept in the theory of anomalous stochastic processes, leads to an optimal search strategy for foraging organisms. This hypothesis is discussed controversially in the current literature. One problem is that Lévy dynamics implies scale-freeness while in complex systems, and especially in biological dynamics, one might expect to see a hierarchy of different spatio-temporal scales. In my talk I will review examples and counterexamples of experimental data and their analyses confirming and refuting the Lévy Flight Foraging Hypothesis. Related to this debate is own work about the biophysical modeling of bumblebee flights under predation threat based on experimental data analysis, which I briefly outline [2].

[1] R. Klages, *Extrem gesucht*, Physik Journal **14**, 22 (2015); *Search for food of birds, fish and insects*, chapter in: A.Bunde et al. (Eds.), Diffusive Spreading in Nature, Technology and Society (Springer, Berlin, 2018)

[2] F.Lenz et al., Phys. Rev. Lett. **108**, 098103 (2012); PLoS ONE **8**, e59036 (2013)