

How can we search efficiently? This is a common and important question in our world. The problem of finding an optimal searching strategy is vital for instance in the context of mobile robots and animal foraging strategies. Research in this direction is conducted in the world best scientific centers. There is a famous hypothesis - *Lévy flight foraging hypothesis* (LFF), which may be stated as follows: the best results in finding goals which are scarcely distributed in a certain area are obtained when performing *Lévy flights* and *Lévy walks*. A trademark of these stochastic processes are frequent long movements in one direction. Classical diffusion models are based on normal (Gaussian) distribution and they do not exhibit this property. Interestingly, recent studies on animal migrations show that in conditions described by the LFF hypothesis animals such as blue sharks, tunas and ocean sunfishes perform Lévy walks. It also appears that Lévy walk is an universal model which can be used to model phenomena such as light transport in certain optical materials or blinking nanocrystals.

The aim of the project is connected with Lévy walks. It is planned to derive their properties and also the properties of associated models - correlated continuous time random walks. From a mathematical point of view these processes are interesting due to their rich structure and connections with a potential theory. Finding their asymptotic (equilibrium) properties will also significantly contribute to the development of the theory of stochastic processes.

Another important reason behind the proposed project are potential practical applications. The first potential application is the already mentioned question of determining an optimal search strategy. In a language of stochastic processes the problem of finding a target (for instance food) can be expressed as a first hitting time of a certain set. Determining the statistical description of the first hitting times is one of the goals of this research project. Obtaining this goal can be a step towards verification of the LFF hypothesis. The results of the project can also help in constructing statistical tests for detection and identification of the anomaly type in experimental data. This is one of the fundamental challenges when interpreting results of biological and physical experiments.