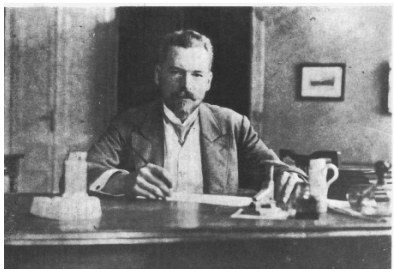

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Celestial mechanics of fruit flies or a theory for mushroomers

Monday, 3 September 2018 09:00 (45 minutes)

The topic of global search in complex environments have been often investigated. But a search can also be local in the sense that it is centered at a given home position. In the latter case, the searcher does not only look for a new target but is also required to regularly return to the home position. Such behavior is typical for many insects and achieves technical importance for self-navigating robotic systems. We propose a stochastic nonlinear model for local search which does not distinguish between the two aims. The dynamics bases on an active particle moving with constant speed. It performs a pursuit and escape behavior of the heading from the position vector realizing thereby optimal exploration of space and the return to the home. We discuss the mechanics of the searcher and inspect the role of noise. Such randomness is present in the decision making rule of selecting the new heading direction. We consider Levy noises with different degree of discontinuity and report about steady spatial densities for the searchers. Also we report about an optimal noise intensity that a searcher finds a target at nearby places. For this noise value the required time for finding the target becomes minimal which appears to be the consequence of different relaxation processes in the spatial and the angular dynamics. Further extensions of the model are discussed during the lecture.

J. Nötel, V.L.S. Freitas, E. E.N. Macau, and L. Schimansky-Geier, “A class of stochastic models for local search”, Phys. Rev. E accepted for publication.

J. Nötel, V.L.S. Freitas, E. E.N. Macau, and L. Schimansky-Geier, “Search and return model for stochastic path integrators”, CHAOS, accepted for publication.

Primary author: Prof. SCHIMANSKY-GEIER, Lutz (Department of Physics, Humboldt-University at Berlin)

Presenter: Prof. SCHIMANSKY-GEIER, Lutz (Department of Physics, Humboldt-University at Berlin)

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