

Title: Statistical data analysis and stochastic modeling of radar-tracked bumblebee flights in the wild

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Description: In the group of Prof. Chittka there are new data sets available, extracted from an experiment in the wild where bumblebees have been followed with radar tracking over long distances in a 'travelling salesman'-type foraging problem [1]. In a previous PhD project we developed a stochastic model of bumblebee flights, based on the analysis of data from a laboratory experiment of the Chittka group [2]. The goal of this PhD project is a) to explore whether the stochastic model of [2] can be adapted to understand the new data of [1], and b) to develop a stochastic theory of bumblebee foraging in the wild by testing the so-called Levy flight hypothesis of optimal foraging efficiency [3].

Background: Initiated by a small grant from the QMUL Bridging the Gaps initiative in 2008, there emerged a highly cross-disciplinary, very fruitful collaboration between Thomas Ings and Lars Chittka at SBCS, and Rainer Klages at SMS on the mathematical modeling of the foraging dynamics of bumblebees. A powerful set of statistical tools has been developed by a recent PhD student at SMS from analyzing data sets created in a previous experiment at SBCS. The application of these methods enabled us to construct integrative mathematical models reproducing the bee dynamics. This project led to two publications in high impact journals [2,4]. The data that should now be analyzed got published by the Chittka team in another widely cited high impact journal [1]. Both [1] and [4] went through the international press. These publications indicate the scientific calibre of the newly proposed PhD project.

Biophysical foraging theories define a very recent, extremely active and important area of research. The results are typically disseminated in high impact journals, with wide-ranging implications on topics such as the prediction and modeling of epidemic spreading.

References:

- [1] M.Lihoreau et al., PLoS Biol 10, e1001392 (2012).
- [2] F.Lenz, A.V.Chechkin, R.Klages, PLoS ONE 8, e59036 (2013)
- [3] G. Viswanathan, M. da Luz, E. Raposo, and H. Stanley, The Physics of Foraging (Cambridge University Press, Cambridge, England, 2011).
- [4] F. Lenz et al. Phys. Rev. Lett. 108, 098103 (2012).