Prize Talk PV V Tue 13:00 HSZ 01

Lévy Random Walks: From the Dispersal of Dollar Bills to New Models for the Forecast of Epidemics — •Theo Geisel — MPI für Dynamik und Selbstorganisation und Fakultät Physik der Universität Göttingen — Träger des Gentner-Kastler-Preises

Since their introduction in chaotic systems that exhibit anomalous diffusion [1], Lévy random walks have been discovered and modeled in various scientific contexts for more than two decades. In a recent application we have suggested their use for the description of human dispersal on geographical scales, a key factor for the spatiotemporal modeling of epidemics. While the *local* infection dynamics is well understood for many diseases, the efficiency of epidemic forecasts has suffered in the past from a poor description of the *spatial* dynamics, as little was known about the statistical laws by which humans and their pathogens disperse.

How can one obtain reliable information on traveling statistics, if people can travel using very different means of transportation from bikes to planes? We have studied this problem empirically using the dispersal of bank notes as a proxy [2]. Dollar bills were tracked based on the dataset of the internet game wheresgeorge.com. Their dispersal can be described very accurately in terms of an ambivalent super- and subdiffusive process in a model very similar to the one introduced in Ref. [1]. The model needs 3 parameters only and predicts a spatiotemporal scaling law for the time dependent probability density in very good agreement with the empirical data.

[1] T. Geisel, J. Nierwetberg, and A. Zacherl, Phys. Rev. Lett. 54, 616 (1985).
[2] D. Brockmann, L. Hufnagel, and T. Geisel, Nature 439, 462 (2006).