The Scaling Laws of Human Travel
- New Approaches to the Forecast of Epidemics in a Globalized World

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Many infectious diseases are transmitted from person to person and human travel is responsible for their geographical spread. In order to model, forecast, and control the spread of epidemics, one needs to know the statistical mechanics of human travel. How can we obtain reliable information on travelling statistics, if people can travel using very different means of transportation from bikes to planes? We have studied this problem empirically and theoretically using the dispersal of dollar bills as a proxy. The time dependent probability density obtained in this way exhibits pronounced spatiotemporal scaling and anomalous diffusion, which mathematically can be described very accurately in terms of a bifractional diffusion equation with few parameters.

*work in collaboration with D. Brockmann and L. Hufnagel

References:

[1] D. Brockmann, L. Hufnagel, and T. Geisel, "The scaling laws of human travel", Nature **439**, 462 (2006).

[2] L. Hufnagel, D. Brockmann, and T. Geisel, "Forecast and control of epidemics in a globalized world", *PNAS*, **101**, 15124 (2004).