Anomalous diffusion, non-Gaussianity and long-range dependent motion

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Deviations from the standard laws of Brownian motion, the linear time dependence of the mean squared displacement and the Gaussian probability density function, are quite commonly observed in an adundance of systems [1]. The physical mechanisms for these anomalies are non-universal, prompting the need for different stochastic models along with their identification from measured time series of dynamic motion. The model classification and parameter regression of anomalous diffusion can be successfully achieved by machine-learning tools such as Bayesian Deep Learning [2], which will be introduced along with a brief summary of the two recent AnDi (Anomalous Diffusion) Challenges [3,4].

The talk will focus on long-range dependent stochastic motion, identified in a large range of systems [5]. In particular, it will be discussed how to generalise such models to situations, in which the observed probability density is non-Gaussian, or when the processes display scaling exponents varying in time or space. Diffusion models with stochastically [6,7] and deterministically [8] varying diffusion coefficients and scaling exponents will be introduced. Applications to experimental data will be discussed.

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