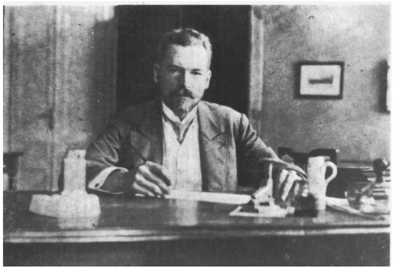

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Brownian yet non-Gaussian diffusion in models of disordered systems

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Experimental possibility of single particle tracking on molecular scales lead to a splash of interest to the precise forms of the probability density functions (PDFs) of displacements of classical particles diffusing in complex environments. This lead to the discovery of an intriguing phenomenon of Brownian yet non-Gaussian diffusion in which these PDFs are strongly non-Gaussian (at least at short times, when they typically have a tent-like shape) with slow convergence to Gaussian at long times, while the mean squared displacement grows linearly in time in the whole time domain, like in normal diffusion. The phenomenon is probably not mono-causal, and several models for this were proposed. These models can be roughly divided into two classes: the ones with time-dependent (fluctuating) diffusivity, and the ones, in which diffusion in static, correlated random environments is considered. We show that the behavior of the PDF in these two classes of models during the convergence to a Gaussian is very different.

In models of fluctuating diffusivities, like in usual diffusion, the concentration profile, starting from an initial distribution showing sharp features, rapidly gets smooth and then converges to a Gaussian. The art of convergence to a Gaussian in diffusion in disordered media with infinite contrast may be strikingly different: sharp features of initial distribution do not smooth out at long times and persist indefinitely. This peculiarity of the strong disorder may be of importance for diagnostics of disorder in complex, e.g. biological, systems.

Primary author: SOKOLOV, Igor (Humbold University at Berlin)

Presenter: SOKOLOV, Igor (Humbold University at Berlin)

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