Research (What is it about?)	**Superdiffusive dispersals and the geometry of random walks**
UNN authors	*Zaburdaev V., Denisov S.*
We find (The result)	The new type of stochastic movements (two-dimensional class of "***Lévy walks***" including superdiffusion), which do not describes Brownian model, has been retrieved. The probability density function has been founded in dependence of model parameters of this class.
Abstract	The Lévy walk model was developed to describe spreading phenomena that were not fitting the paradigm of Brownian diffusion. With a very broad distribution of the excursions' lengths, the corresponding processes exhibit dispersal faster than in the case of normal diffusion. Conventionally, this difference is quantified with the mean squared displacement, $\langle r^2(t)\rangle \propto t^{\alpha}$, and the regime with $\alpha > 1$ is called superdiffusion. Examples of such systems range from cold atoms moving in dissipative optical lattices to T cells migrating in the brain tissue. The existing theoretical results, however, were derived for one-dimensional Lévy walk processes. In contrast, real-life phenomena – biological motility (from bacteria to humans and autonomous robots), animal foraging, and search – happen in two dimensions. We begin with a core of the Lévy walk concept: A particle performs ballistic moves with constant speed, alternated by instantaneous reorientation events, and the length of the moves is a random variable with a powerlaw distribution. Because of the constant speed v_0, the length l_i and duration τ_i of the ith move are linearly coupled, $l_i = v_0 \tau_i$. As a result, the model can be equally well defined by the distribution of ballistic move (flight) times: $$\psi(\tau) = \frac{1}{\tau}\frac{\gamma}{(1+\frac{\tau}{\tau_0})^{1+\gamma}}.$$ Depending on the value of γ, it can lead to a dispersal $\alpha = 1$, typical for normal diffusion ($\gamma > 2$), and very long excursions leading to the fast dispersal with $1 < \alpha \leq 2$ in the case of superdiffusion ($0 < \gamma < 2$). At each moment of time t the finite speed sets the ballistic front beyond which there are no particles. We show that, in contrast to standard random walks, the microscopic geometry of planar superdiffusive Lévy walks is imprinted in the asymptotic distribution of the walkers. The geometry of the underlying walk can be inferred from trajectories of the walkers by calculating the analogue of the Pearson coefficient.

Representative articles 2016-2017, quartiles	1. *Zaburdaev V., Fouxon I., Denisov S., Barkai E.* Superdiffusive Dispersals Impart the Geometry of Underlying Random Walks. Phys. Rev. Lett. 27: 270601 (2016).	Q1
	Q-index (Qi) of the result	**4**

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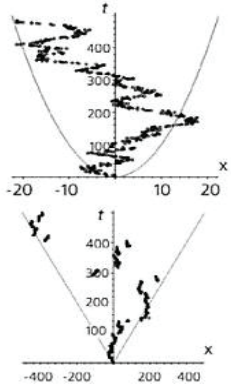
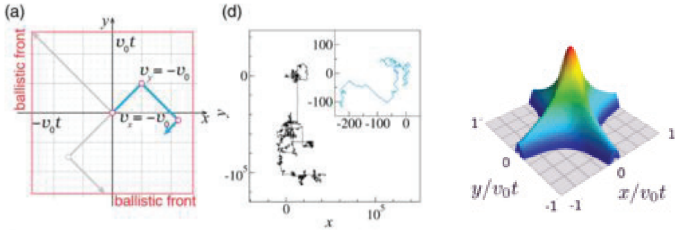
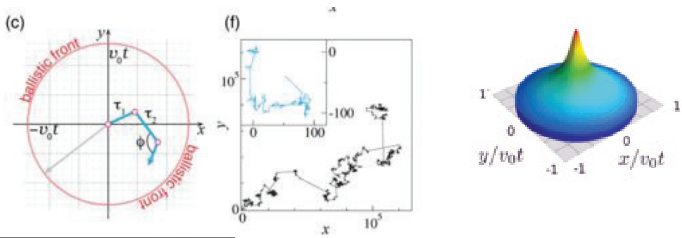


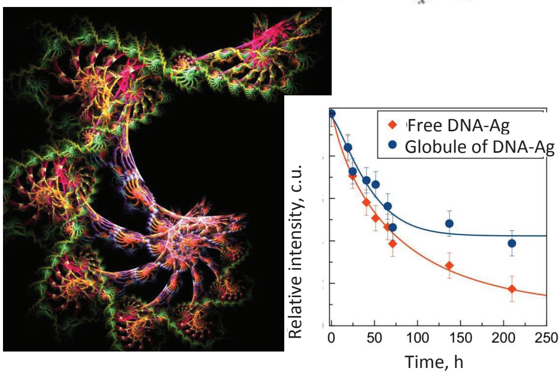
One-dimensional stochastic movements: subsequent positions of particle for normal diffusion (above) and superdiffusion (below). The gaps are Lévy flights.

Two-dimensional Lévy walks: the model of independent movements by coordinates. Subsequent positions of particle (for different scales) and the probability density function are shown.



Lévy walks in the model of random choice for directions of movement in plane:





Superdiffusion in fractal globules of DNA.