[Talk 19] Stochastic modeling and elucidation of superdiffusive transport in living cells

Jae-Hyung Jeon, KIAS

Biological cells are a sack of living materials of various sizes and species comprised of, e.g., the proteins, biopolymers, and organelles. It is known that the cells are supercrowded with these intracellular materials beyond our naïve speculation, at volume occupancy up to ~40% of the cell volume. For maintaining the living process various intracellular transport occurs in the cell. Experimental studies based on the state-of-the-art single particle tracking tools have shown that in such crowded and viscoelastic environments the particle movement usually disobeys the Einstein's simple law of Brownian diffusion, instead carrying out anomalous transport. Over the last decade the subdiffusion of various intracellular particles has been extensively studied on both experimental and theoretical sides [1,2]. Currently, a challenging task is to understand the motor-driven superdiffusive transport in the supercrowded living environments. In this talk, I discuss two distinct superdiffusive phenomena in living cells, recently studied with experimentalists, which illustrate distinguished stochastic dynamics stemming from different origins [3]. It is shown that analogously to the passive transport the intracellular superdiffusion exhibits stochastically diverse dynamic patterns due to multiple factors. We quantify the single-molecule stochastic dynamics in detail in the framework of established superdiffusion models and elucidate the origins of the superdiffusive transport.

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[2] R. Metzler, J.-H. Jeon, A. G. Cherstvy, and E. Barkai, Phys. Chem. Chem. Phys. **16**, 24128 (2014).
[3] J. F. Reverey et al., Sci. Rep. **5**, 11690 (2015).