Anomalous diffusion with heterogeneity in view of superstatistics

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There exists an exotic phenomenon from the traditional perspective of anomalous diffusion. Such a phenomenon has experimentally been observed in the infection pathway of adeno-associated viruses in living *HeLa* cells [1]. Remarkably, the exponent of anomalous diffusion of the virus, which exhibits stochastic motion in the free form as well as the form being contained in the endosome, fluctuates depending on localized areas of cytoplasm of the cell, in marked contrast to traditional anomalous diffusion. Here, from the viewpoint of superstatistics [2], which is a "statistics of statistics" with two largely-separated time scales and aims to describe nonequilibrium complex systems with two such time scales, a theoretical framework [3] is developed to establish a generalized fractional kinetics [4] for describing the infection pathway of the virus in the cytoplasm. In this theory, the existence of a large separation of two time scales in the infection pathway is explicitly taken into account. It is also shown within the present framework that the motion of the virus may obey a scaling law.

References

[1] G. Seisenberger, M.U. Ried, T. Endreß, H. Büning, M. Hallek, C. Bräuchle: *Real-time single-molecule imaging of the infection pathway of an adeno-associated virus*. Science **294**, 1929-1932 (2001).

[2] C. Beck, E.G.D. Cohen: *Superstatistics*. Physica A **322**, 267-275 (2003).

[3] Y. Itto: *Heterogeneous anomalous diffusion in view of superstatistics*. Phys. Lett. A **378**, 3037-3040 (2014).

[4] Y. Itto: *Heterogeneous anomalous diffusion of a virus in the cytoplasm of a living cell*. J. Biol. Phys. **38**, 673-679 (2012).