

Ergodicity violation and ageing: from granular gases to living cells

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ABSTRACT

In 1905 Einstein formulated the laws of diffusion, and in 1908 Perrin published his Nobel-prize winning studies determining Avogadro's number from diffusion measurements. With similar, more refined techniques the diffusion behaviour in complex systems such as the motion of tracer particles in living biological cells is nowadays measured with high precision. Often the diffusion turns out to deviate from Einstein's laws. This talk will discuss the basic mechanisms leading to anomalous diffusion as well as point out the physical consequences. In particular the unconventional behaviour of non-ergodic, ageing systems will be discussed within the framework of different stochastic processes [1,2].

The effects of non-ergodicity and ageing will be analysed in detail for specific physical systems such as the motion of particles in granular gases, tracer diffusion in flexible gels and in living biological cells, as well as in quenched energy landscapes. Moreover, many-particle effects with interactions will be addressed.

REFERENCES

- [1] R. Metzler, J.-H. Jeon, A. G. Cherstvy & E. Barkai, *Phys. Chem. Chem. Phys.* **16**, 24128 (2014).
- [2] E. Barkai, Y. Garini & R. Metzler, *Phys. Today* **65**(8), 29 (2012).