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Rare events in some fat tailed systems

We investigate rare fluctuations in diffusive systems whose typical bulk behavior is described by long tailed Lévy statistics. Many diffusive systems exhibit a bi-fractal behavior also called strong anomalous diffusion [1]. Here $\langle |x(t)|^q \rangle \sim t^{q\nu(q)}$ and $q\nu(q)$ is a bi-linear function of q . Using the well-known Lévy walk model we show how this is related to infinite covariant densities, i.e., non normalised states that describe the rare fluctuations [2]. These infinite densities are complementary to the generalised central limit theorem. Such behaviour is found in several microscopic models including transport of cold atoms in optical lattices [3], the Lorentz gas with infinite horizon, and experiments following active tracers in the live cell.

References

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