basque center for applied mathematics

Scientific Seminar

Tuesday, January 22nd, 16:00-17:00

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FRACTIONAL DIFFUSION PROCESSES FROM HETEROGENEOUS ENSEMBLE OF BROWNIAN PARTICLES

Anomalous diffusion emerges ubiquitously in many complex multi-component systems. This is often associated with the failing of the basic assumption of the Gaussian central limit theorem: (i) independence and (ii) finite size of successive displacements. This usually occurs in ensembles made of different units (i.e., particles) having homogeneous physical properties. In this case, each particle follows its own trajectory according to the temporal stochastic

dynamics depending on the environmental fluctuations and, possibly, on the particular initial conditions, but single particle dynamics do not change from one particle to the other.

On the contrary, when considering an ensemble of particles with heterogeneous physical properties (e.g., different masses and/or sizes), the dynamical features are different from one particle to another one, even when both particles feel the same environmental fluctuations, i.e., thermal noise.

In this talk we discuss a recently proposed approach to anomalous diffusion based on a heterogeneous ensemble of Brownian particles. The single trajectory is a standard Brownian motion, but the ensemble average, corresponding to the centre-of-mass dynamical evolution, shows the typical features of anomalous diffusion: anomalous space-time scaling, long-range temporal

correlations and power-law decay in the displacement distribution.

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