FRACTIONAL KINETIC EQUATIONS FOR SUPERDIFFUSION

A. V. Chechkin

Institute for Single Crystals,
Nat. Acad. of Sci. of Ukraine
(*60, Lenin Prosp., Kharkov 61001, Ukraine*)

By using the classical procedure for derivation of kinetic equations for the Brownian motion, we get fractional kinetic equations for the Levy motion. Namely, we derive the fractional symmetric Einstein – Smoluchowski equation for the probability density function in the coordinate space and the fractional symmetric Fokker – Planck equation for the probability density function in the phase space. The former equation contains a symmetric space fractional derivative and describes the process of superdiffusion, whereas the latter contains a symmetric velocity fractional derivative and describes both relaxation processes over velocity and coordinate as well. As an example, we solve both equations in a force-free case, get characteristic times for the velocity and the coordinate relaxation and show criteria for the transition from a description in the phase space to a description in the real space.