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Generalized fractional Fokker-Planck equation for anomalous diffusion ALEX VEKSLER, RONY GRANEK, Ben-Gurion University of the Negev, Beer Sheva, Israel — The problem of anomalous diffusion is important for a variety of systems, such as fluids, glasses, polymers, proteins etc. It is characterized by a mean square displacement evolving in time as a power-law $\langle x^2 \rangle = 2D_0 t^\alpha$. However, a Fokker-Planck-like equation which could describe a stationary Gaussian process with anomalous-diffusion behavior, such as the one described by the Generalized Langevin equation, is still missing. We propose a generalization for constant force to the fractional Fokker-Planck equation (fFP) [Metzler, R. and Klafter, J., Phys. Rep. **339** (2000), 1-77], based on a series expansion in spatial and fractional time derivatives and powers of the Fokker-Planck operator. The proposed equation, GfFP, recovers the generalized Einstein relation and leads to Gaussian distribution, in particular, for free particle diffusion. We apply GfFP to 1-D first passage time problem. The long-time asymptote of the probability distribution behaves like $\exp(-t^\alpha)$. This contrasts with the power-law behavior of the corresponding solutions of the fFP. We further propose to generalize GfFP for treating other outstanding problems, such as the anomalous diffusion under an harmonic potential and the Kramers‘ escape problem.

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