Some Results for Nonlinear Diffusion Equations with Stochastic Resetting

Ervin K. Lenzi[a,b], Rafael S. Zola[c], Michely P. Rosseto[a], Renio S. Mendes[b,d], Haroldo V. Ribeiro[d], Luciano R. da Silva[b,e], Luiz R. Evangelista[d]

[a] Universidade Estadual de Ponta Grossa, Ponta Grossa, Brazil
[b] National Institute of Science and Technology for Complex Systems, Rio de Janeiro, Brazil
[c] Universidade Tecnológica Federal do Paraná, Apucarana, Brazil
[d] Universidade Estadual de Maringá, Maringá, Brazil
[e] Universidade Federal do Rio Grande do Norte, Natal, Brazil

We investigate a nonlinear diffusion process where particles stochastically reset to their initial positions at a constant rate. The nonlinear diffusion process is modeled using the porous media equation and its extensions, which are nonlinear diffusion equations. We use analytical and numerical calculations to obtain and interpret the probability distribution of the position of the particles and the mean square displacement. These results are further compared and shown to agree with numerical simulation results. Our findings show that a system of this kind exhibits non-Gaussian distributions, transient anomalous diffusion (subdiffusion and superdiffusion), and stationary states that simultaneously depend on the nonlinearity and resetting rate.