

# From the nonlinear Fokker-Planck equation to the Vlasov description and back: confined interacting particles with drag

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Nonlinear Fokker-Planck equations endowed with power-law diffusion terms have proven to be valuable tools for the study of diverse complex systems in physics, biology, and other fields. The nonlinearity appearing in these evolution equations can be interpreted as providing an effective description of a system of particles interacting via short-range forces while performing overdamped motion under the effect of an external confining potential. This point of view has been recently applied to the study of thermodynamical features of interacting vortices in type-II superconductors. In this talk we explore an embedding of the nonlinear Fokker-Planck equation within a Vlasov equation, thus incorporating inertial effects to the particle dynamics. Exact time-dependent solutions of the q-Gaussian form (with compact support) are obtained for the Vlasov equation in the case of quadratic confining potentials [1].

[1] A. R. Plastino, E. M. F. Curado, F. D. Nobre and C. Tsallis, Phys. Rev. E 97, 022120 (2018)