A theory of non-local linear drift wave transport

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The aim of this study is to elucidate on the effects of a non-Maxwellian distribution function induced by the fractional velocity derivative in the Fokker-Planck (FP) equation. The fractional derivative is represented with the Fourier transform containing a fractional exponent. We find a relation for the deviation from Maxwellian distribution described by ϵ through the quasi-neutrality condition and the characteristics of the plasma drift wave are fundamentally changed, i.e. the values of the growth-rate γ and real frequency ω are significantly altered. On the one hand, a deviation from the Maxwellian distribution function alters the dispersion relation for the density gradient drift waves such that the growth rates are substantially increased and thereby may cause enhanced levels of transport. On the other hand, for a given plasma turbulence (γ and ω) it is found that small deviations (a few percent) from a Maxwellian distribution function is expected when the linear growth rate of the drift wave rises above a critical value.