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Francis Filbet (talk 4): A structure and asymptotic preserving scheme for the quasi-neutral limit of the Vlasov-Poisson system

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We propose a numerical method for the Vlasov-Poisson system which is asymptotically consistent and stable in the quasi-neutral limit, that is, when the Debye length is small compared to the scale of the domain. The Vlasov-Poisson system is written as an hyperbolic system thanks to a spectral decomposition in the basis of Hermite functions with respect to the velocity variable, then a structure preserving finite volume scheme for the space variable is designed. On the one hand, we show that the Hermite formulation is adequate to study the quasi-neutral limit and get error estimates between the solution to the Vlasov-Poisson system and its asymptotic limit. On the other hand, we apply a numerical scheme, inspired by the previous work, to recover a consistent approximation of the quasi-neutral limit. Finally, we perform substantial numerical simulations to illustrate the efficiency of this approach for a large variety of regimes and to highlight its robustness (conditional stability, asymptotic preserving properties).