Transverse Instability of self-consistently formed BGK-like modes

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The Vlasov-Poisson system of equations admits a family of exact, non-linear solutions called Bernstein-Greene-Kruskal (BGK) modes [1], which have been observed to persist in both the magnetosphere and solar wind [2].

Sustained upon the concept of particle trapping, BGK-like modes are usually stable when restricted to one spatial dimension, but become potentially unstable in the presence of perturbations transverse to their trapping direction. The signature of this instability has been identified in multiple satellite observations [3]; PIC studies have succeeded in finding stability criteria for electron holes [4]; and Vlasov simulations have verified the transverse instability of Ion-Acoustic waves, but the associated growth rates are yet to be explained [5].

To provide further evidence on the destabilization process of this kind of structure, the results of two-dimensional, unmagnetized, Vlasov simulations are discussed, where BGK-like modes are self-consistently formed from pseudo-acoustic perturbations using velocity-unstable distributions.

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