1E34

Shear and Compressional Alfven Waves in Gyrokinetic Plasmas*

W. W. Lee, J. L. V. Lewandowski, H. Qin and T. Jenkins
Princeton Plasma Physics Laboratory
Princeton, NJ 08543

Theoretical and numerical properties of shear Alfven and compressional Alfven waves in gyrokinetic plasmas in toroidal geometry are presented:

1) We will show that the difference in treating the polarization drift between the MHD and gyrokinetic formalism leads a totally different relationship between the two branches of Alfven waves. In the gyrokinetic formalism, there is a natural separation between them through frequency ordering, whereas, in the MHD limit, the separation can only be achieved through geometric ordering. The simple treatment presented here helps to understand the underlying physics and is in agreement with the previous analyses based on the more formal procedures of gyrokinetic ordering.[1,2]

2) We have also extended the original split-weight particle simulation scheme[3] based on $F = F_0 + \psi F_0 + \delta h$ within the $v_{||}$ formalism to a more general geometry, where $\psi = \phi + (1/c) \int A_{||} dx_{||0}$ is calculated along the unperturbed orbit. A more complete derivation for toroidal plasmas will be presented elsewhere.[4]

3) The possibility of simulating microturbulence in the transport time scale based on gyrokinetic particle simulation will also be explored. It involves the interplay between 1) shear Alfven physics in the presence of spatial inhomogeneity, 2) profile modification, 3) pressure balance equation, and 4) changing magnetic equilibria. Details will be discussed.

* Work supported by US DoE.

[1] W. W. Lee, Phys. Fluids (1983).
[2] H. Qin, W. M. Tang , W. W. Lee and R. Rewoldt, Phys. Plasmas **6**, 1575 (1999).
[3] W. W. Lee, J. L. V. Lewandowski, T. S. Hahm, and Z. Lin, Phys. Plasmas **8**, 4435 (2001).
[4] J. Lewandowski, private communication.