

Ponderomotive forces in plasmas described by Kappa distributions

Joaquín Espinoza^{1*}, Pablo Moya^{2†}, Felipe Asenjo^{1,2}

¹Departamento de Física, Facultad de Ciencias, Universidad de Chile, Santiago, Chile
*joaquinun@gmail.com

Abstract

In this work we study the Washimi and Karpman ponderomotive interaction due to electromagnetic waves propagation in magnetized and unmagnetized plasmas described by a isotropic Kappa distribution. We have give a brief analysis of the influence of the Kappa distribution in the dispersion relations for a low temperature plasma expansion at the lowest order in which the thermal effects are appreciated. The spatial and temporal factor of the ponderomotive force is obtained as a function of the wavenumber, the spectral index and the thermal velocity and light velocity ratio (for unmagnetized plasmas) and the plasma beta (for magnetized plasmas). It is found for unmagnetized plasmas that for the ponderomotive spatial factor the non-thermal effect is negligible for non-relativistic thermal velocities. However, for unmagnetized plasmas the temporal factor of the ponderomotive force appears only due to thermal effects so the spectral index has a more significant role [1]. While for magnetized plasmas we have found that the non-thermal effect has a more significant role in the ponderomotive force. It is found that the magnitude of the spatial term and the temporal term of the ponderomotive force originated because of the electron cyclotron waves increases as we move away from thermal equilibrium. This last case it is relevant in space physics phenomena where we usually find plasmas described by Kappa distributions in the presence of external magnetic fields, and where the spatial and temporal terms of the ponderomotive force of the cyclotron waves appears in a variety of phenomena related with the terrestrial magnetosphere among others [2].

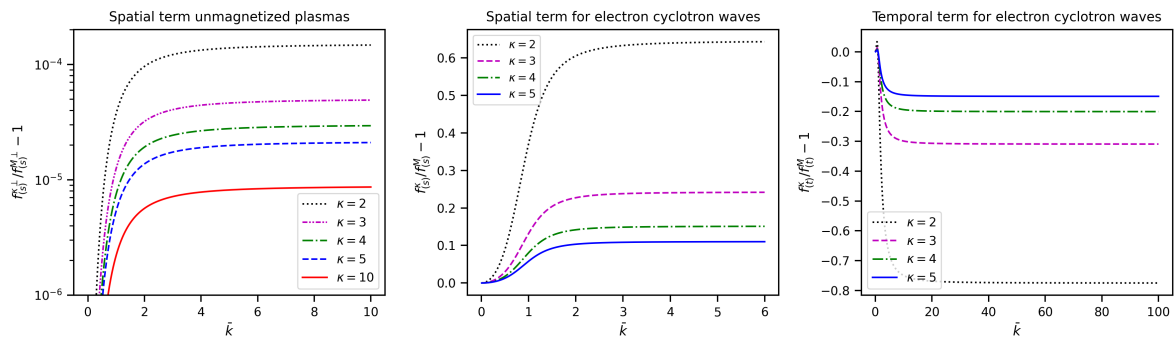


Figure 1: Ratio f_s^κ / f_s^M of the spatial term factors for the ponderomotive force for Kappa distributed plasmas f_s^κ and Maxwellian plasmas f_s^M .

References

- [1] Joaquín Espinoza, Pablo Moya, Felipe Asenjo. Ponderomotive forces in unmagnetized plas-

mas described by Kappa distribution functions (in preparation)

[2] Lundin, R., & Guglielmi, A. (2006). Ponderomotive Forces in Cosmos. *Space Science Reviews*, 127(1-4), 1-116.