Plasma Physics I

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Exercise 1

To study wave-plasma interactions, often we can assume to have waves with a perturbation of the electric field only ($B_1 = 0$, the electrostatic approximation).

Consider the fluid model of a cold plasma, with $T = 0$ and $B_0 \neq 0$. Which waves can be considered as electrostatic based on the definition given above? Consider only the case $\vec{k} \parallel \vec{B_0}$.

Exercise 2

The uni-dimensional *Fokker-Planck* equation with collision frequency ν independent of the velocity w,

$$\frac{\partial f_t}{\partial t} = \nu \frac{\partial}{\partial w} \left(w f_t + v_{th,f}^2 \frac{\partial f_t}{\partial w} \right)$$

can be used to describe the evolution of the distribution f_t of *test* particles colliding with a Maxwellian population of *field* particles with same mass m, constant temperature T_f and $v_{th,f} = (T_f/m)^{1/2}$.

Show that in stationary conditions the distribution function f_t is a Maxwellian with the same temperature as the *field* particles.