Problem sheet 6

Plasma Physics course
TU Dresden
Lecturer: Katerina Falk
Summer semester April – July 2021

Question 1:

In the limit of $T_i \ll T_e$ the ion-acoustic wave has the dispersion relation:

$$\omega(k) = \frac{\omega_{pi}\lambda_{De}k}{(1+k^2\lambda_{De}^2)^{1/2}}$$

a) Derive an expression for the phase velocity $v_\varphi(k)$ and the group velocity $v_g(k)$ as a function of the wave number k.

b) Discuss the result with respect to "acoustic behavior" at $k\lambda_{De} \ll 1$.

Question 2:

The ionospheric F-layer has a plasma density of $n = 10^{12}\ m^{-3}$ and consist of mainly O^+ ions.

a) What is the Alfvén speed at a typical magnetic field of $B = 3\times10^{-5}\ m$?

b) Compare this result with the ion sound speed at a temperature $T_e = T_i = 3000\ K$.