APPH 6101 Plasma Physics I Homework 6: Due 14 October, 2015.

Questions 1

Due problem 6.6 in the Piel textbook:

6.6 The plasma of the ionospheric F-layer has a density $n_e \approx 2 \times 10^{12} \text{ m}^{-3}$. The typical magnetic field at mid-latitude is $B = 50 \,\mu\text{T}$. Calculate the electron plasma frequency f_{pe} , electron cyclotron frequency f_{ce} and the upper hybrid frequency f_{uh} .

Question 2



Figure 1: Sir Edward Appleton (1892-1965) who was awarded the 19478 Nobel Prize in physics. (Right) Fig. 1 from his Nobel Lecture illustrating the paths of direct and reflected radio waves.

Sir Edward Victor Appleton was awarded the Nobel Prize in physics in 1947 for his investigation of radio wave propagation in the ionosphere. In his Nobel Lecture, he described the variations in the reception of radio waves when the direct waves (near ground) interferred with waves reflected from the ionosphere.

Consider radio waves reflected from the so-called "E layer". The E-layer has a plasma density of 10^5 cm⁻³ and is located at an altitude of about 100 km.

Part A

What frequency radio waves can reflect from the E-layer?

Part B

Describe (very approximately) how the received radio signals vary as the distance between the transmitting antenna and the receiving antenna changes.