

所別：太空科學研究所碩士班 一般生 科目：電離層物理

- (1) What is the Chapman Layer? Please explain why the behavior of Earth's ionosphere does not follow the Chapman Layer. (15%)
- (2). Please explain the reason why the relation between critical frequency f_o of normal E layer and solar zenith angle χ follows $f_o \propto (\cos\chi)^{0.25}$. (15%)
- (3). The expression of ionospheric phase refractive index (or Appleton Formula) is given by

$$n_{\pm}^2 = 1 - \frac{X}{1 - iZ - \frac{Y_T^2}{2(1 - X - iZ)} \pm \sqrt{\frac{Y_T^4}{4(1 - X - iZ)^2} + Y_L^2}} \quad (a)$$

and the polarizations R_{\pm} corresponding to n_{\pm} are

$$R_{\pm} = \frac{i}{2Y_L} \left[\frac{Y_T^2}{1 - X - iZ} \mp \sqrt{\frac{Y_T^4}{(1 - X - iZ)^2} + 4Y_L^2} \right] \quad (b)$$

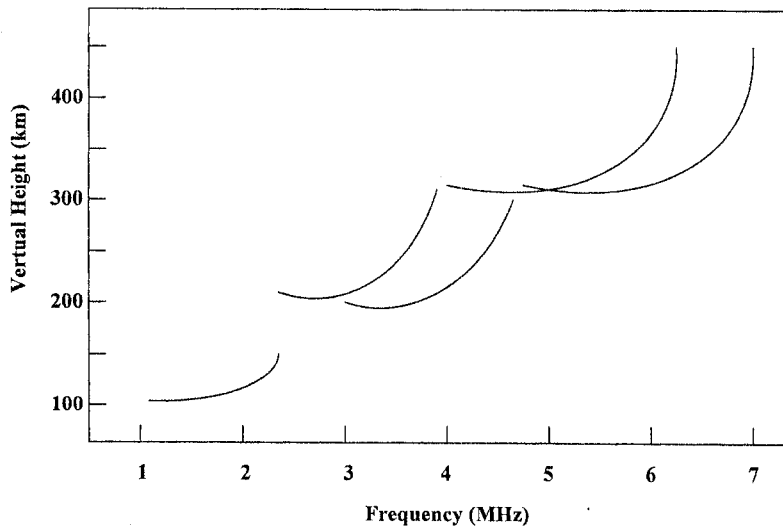
Please answer the following questions:

- (a) Explain the meanings of parameters X, Y_L , Y_T , and Z. (5%)
- (b) Please determine the senses of the rotation of the electric field vectors (right-hand or left-hand polarization) of ordinary wave and extraordinary wave. (10%)
- (c) Please show that in the conditions of $X + Y^2 < 1 + XY_L^2$ and $Z \ll 1$ the phase velocity of ordinary wave is smaller than that of extraordinary wave. (10%)
- (4). The propagation of beacon signals of Global Positioning System (GPS) satellite are significantly affected by the ionospheric electron density and magnetic field line. Please answer the following questions.
- (a) Why can the Quasi-Longitudinal (QL) approximation be used to describe the GPS signal propagation in the ionosphere even under the condition of $\theta=88.5^\circ$, where θ is the angle between GPS wave vector and the magnetic field line. (Assume the carrier frequency of GPS signal is 1.5 GHz). (10%)
- (b) Please estimate the time delay of the GPS signal at frequency 1.2 GHz when it propagates through the ionosphere along the path with Total Electron Content (TEC) of 10^{14} cm^{-2} . (10%)

注意：背面有試題

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- (5). The figure shown below is an example of ionogram. Please estimate the related parameters from the ionogram as more as you can. (10%)



- (6). Please state the formation mechanism of equatorial (or auroral) electrojet and its relation to the Cowling conductivity. (15%)