

所別：太空科學研究所碩士班 科目：電離層物理

- (1). The expression of ionospheric phase refractive index (or Appleton Formula) is given by

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

Please answer the following questions:

- (a) Explain the physical meanings of parameters X, Y<sub>L</sub>, Y<sub>T</sub>, and Z. (10%)
- (b) State the respective wave polarizations of the characteristic waves corresponding to n<sub>+</sub> and n<sub>-</sub>. (5%)
- (c) In deriving the Appleton Formula as above, the assumptions that the ionosphere is neutral in charge, time-independent, linear and isotropic have been made. Please realize these assumptions in terms of proper mathematical expressions. (10%)
- (2). What is the Forbush effect? Please state the plausible connection between Forbush effect and the solar-terrestrial relation. (15%)
- (3). What is the transition height in ionospheric F region? Please state the relation between transition height and the formation of F<sub>1</sub> layer. (20%)
- (4). Assume that an electromagnetic wave with frequency 4x10<sup>8</sup> Hz is transmitted from a satellite to a ground receiver. Assume further that the magnetic flux density and the ionospheric electron density in the path of the wave propagation are, respectively, 0.5 Gauss and 6x10<sup>12</sup> ele/m<sup>3</sup>. If the angle between magnetic field line and the wave vector is 89°, please judge whether quasi-longitudinal approximation can still be applicable to describe the characteristics of the wave propagation. How about for the wave at frequency of 7.1x10<sup>7</sup> Hz? (15%)
- (5) Please state the principle of estimating ionospheric TEC from GPS signal. (15%)
- (6). It is well known that the current and electric field in the Earth's ionosphere are generated through the dynamo effect. Is the ionospheric dynamo in the Earth applicable to the Martian ionosphere? Why? (10%)

參考用