

# Mini-groupwork 3, 2015

## Space Physics, EF2240

- a) A simple model describes the dayside ionospheric electron density at a certain altitude by the following equation:

$$\frac{\partial n_e}{\partial t} = q - \alpha n_e^2$$

where  $q$  is the ionization rate due to solar EUV radiation, and the second term in the right-hand side is the recombination rate. Assuming that the ionosphere is in equilibrium, use data from the figure below to estimate the recombination coefficient  $\alpha$  at 120 km altitude. (Give  $\alpha$  in SI units.) Use the following values for the intensity of EUV radiation above the ionosphere,  $I_0$ , absorption coefficient  $a_a$ , ionization coefficient  $a_i$ , temperature  $T$ , and neutral number density at the surface of Earth,  $n_0$ :

$$I_0 = 3.6 \times 10^{13} \text{ m}^{-2} \text{ s}^{-1}$$

$$a_a = 1.5 \times 10^{-23} \text{ m}^2$$

$$a_i = 0.9 \times 10^{-23} \text{ m}^2$$

$$T = 273 \text{ K}$$

$$n_0 = 2.5 \times 10^{25} \text{ m}^{-2}$$

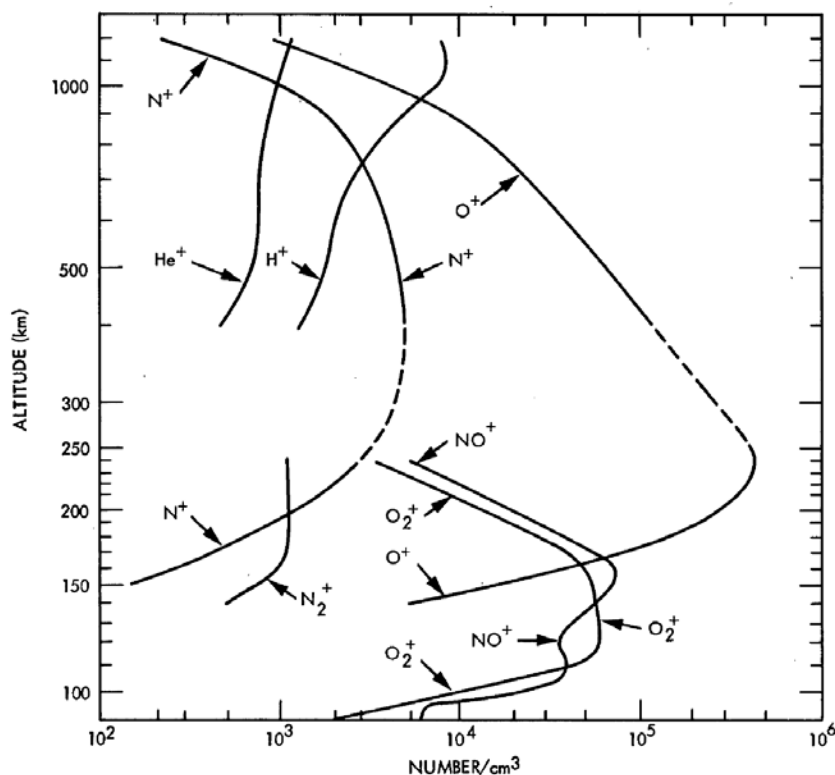


Figure 8 - Ionic composition of solar minimum daytime winter ionosphere (ref. 42).

Please, turn!

**b)** A radio wave pulse with a frequency of 5 MHz is emitted straight upwards from Earth. A receiver registers an echo of this signal at a slightly later time. Estimate the expected time difference between the emission and detection of the pulse, if this experiment would be carried out during daytime, this year.