FYS 3610 EXERCISES WEEK 36

1) Visit NASA's home page for the CGM model of the Earth's magnetic field:
http://nssdc.gsfc.nasa.gov/space/model/models/igrf.html#year

i) Where is the north CGM pole located?

ii) Calculate CGMLat, CGMLon, magnetic conjugate point, L- value, H, D, Z component for the magnetic field, magnetic field strength, Inclination for the following geographic co-ordinates:
University of Oslo: (59.91, 10.73)
University of Tromsø: (69.7, 18.9)
Andøya Rocket Range: (69.28, 16.01)
Longyearbyen: (78.2, 15.7)

2)

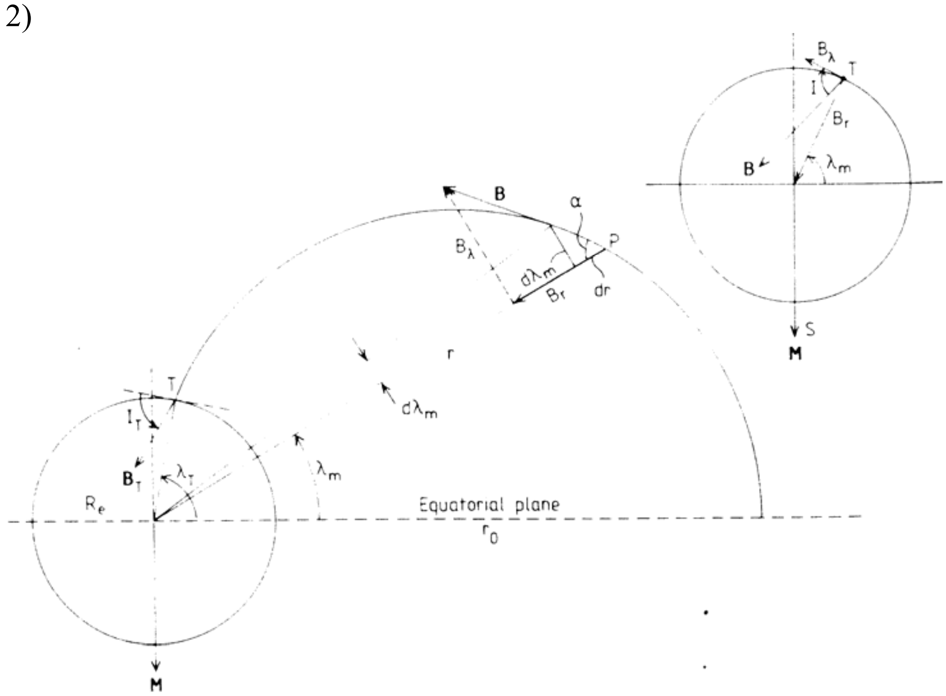

Figure 1: An illustration showing the geometry of the magnetic field line to assist in deriving a geometric formula for B.

Assume a dipole magnetic field. Introducing the magnetic latitude λ_m of which unit vector relates to the co-latitude unit vector defined in the lecture in the following way:

$$\hat{\lambda}_m = -\hat{\theta}$$

Then the magnetic field can be written as:

$$\vec{B} = B_r \hat{r} + B_{\lambda_m} = H_0(-2\sin\lambda_m \hat{r} + \cos\lambda_m \hat{\lambda}_m)$$

i) Show that $L = \frac{r_0}{R_E} = \frac{1}{\cos^2 \lambda_m}$

Hint: $\tan\alpha = \frac{r \cdot d\lambda_m}{dr} = \frac{B_\lambda}{B_r}$

ii) Estimate B-field strength, inclination and L-value based on the dipole model, and compare with corresponding values calculated in Exercise 1.

3) Estimate the magnetopause standoff distance in the case when the solar wind speed is 600 km/s and the solar wind density is 10 cm^{-3}.