FYS 3610

Exercise Week 39 due **05. October 2016**

Questions as they might appear in the mid-term and/or oral exam

How is the ionosphere formed? Describe the different layers!

How do we mathematically describe the change in charged particles with time? What is photo-chemical equilibrium?

What are the types of loss mechanism for ionospheric particles?

What is a Chapman-α layer?

Why does the charged particle density not drop to zero at night?

Exercises

The International Reference Ionosphere (IRI) is an empirical model that describes the different parameters of the ionosphere as a function of time, location, and geomagnetic activity (see http://iri.gsfc.nasa.gov/). You can run the model online at http://omniweb.gsfc.nasa.gov/vitmo/iri_vitmo.html.

a) Use the website to create a plot of the electron density as a function of altitude between 60 km and 600 km for March 21st 2005, 00 UT at 67°N and 0°E at a reasonable resolution. Enter the given parameters in the top, leave the "Optional Inputs" untouched and select "Plot model data", then click "Submit Query" (any of the "Submit Query"-buttons should work). Alternatively, you can choose "List data", save the output as ASCII file and use your favorite plotting tool to create the plot.
b) Do the same plot for 12 UT. Discuss the differences!
c) Now plot the electron density profile for March 21st 2001, 12 UT. Why is the profile different? Discuss your results!

The MSISE model describes the neutral temperature and densities in Earth's atmosphere from ground to thermospheric heights (http://modelweb.gsfc.nasa.gov/atmos/msise.html). The model can be run online at http://omniweb.gsfc.nasa.gov/vitmo/msis_vitmo.html.

a) Use the web interface the create a listing of the molecular oxygen density between 100 km and 1000 km altitude at 100 km resolution on March 21st 2005, 12 UT, at 67°N and 0°E.
b) Use the IRI model to list the densities of singly charged nitrogen for the same day for the same altitude range.
a) The reaction rate for the chemical reaction $N^+ + O_2 \rightarrow NO^+ + O$ is 2.6×10^{-16} m³/s. Using the model values, calculate an altitude profile of the loss rate of N^+. Beware of the units of the model output!