

FYS3610 Exercises Week 37

Descriptive questions:

- a) Survey the main properties of solar wind at Earth orbit.
- b) Discuss the gas dynamic model of the solar wind. Point out the assumptions made. Derive Eq. 6.14, and discuss the solutions in Figure 6.3.
- c) Derive the jet line angle in the Parker Spiral.
- d) What are the sources of the fast and slow solar wind respectively?
- e) d) Sketch the following solar wind structures in the ecliptic and explain why wind from different source regions cannot mix with wind from other source regions: High speed stream, slow solar wind, fast solar wind. What do we mean by compression and rarefaction regions, and how do they form?
- f) Explain how the distribution of the source regions for slow and fast solar wind on the Sun changes from solar maximum to solar minimum, and how this affects the interplanetary magnetic field beyond the exobase ($3 R_s$)
- g) Why do current sheets form at magnetic sector boundaries?

Exercises:

- a) Estimate the Sun's mass loss rate due to solar wind. How is that compared to the mass loss rate due the fusion process?
- b) Plug in numbers in Eq. 6.17.
- c) The NASA satellite ACE is used for monitoring the solar wind. It is located at the first Lagrange point L1 around $230 R_E$ upstream. Visit the following homepage <http://sec.noaa.gov/ace/> and get yourself familiar with it.. Concentrate on the Real Time Data and Dynamics plots, and plot data from MAG and SWEPAM (6 hours time scale). Explain the co-ordinate system. List up the different parameters that are plotted in the MAG and SWEPAM plots. What is the typical range for each parameter? Estimate a typical time delay from plasma is being probed by the satellite until the same plasma impinge on the magnetopause at ~ 10 Earth radii.

Exercises from the book :

6.1 and 6.3