Exercises for October 30

Waves

A

Deduce the wave speeds and the Eigenvectors they correspond with by using: 16, 17 and 18 in the notes on waves, as well as inserting $V_A = \sqrt{\frac{B_0^2}{\mu_0 \rho_0}}$ and $V_S = \sqrt{\frac{\gamma p_0}{\rho_0}}$, that $\mathbf{B_0} \parallel \mathbf{z}$ and that $\mathbf{k} \perp \mathbf{y}$ and that θ is the angle between $\mathbf{B_0}$ and $\mathbf{k}$.

B

How can the three different wave modes be detected in the solar atmosphere if:

1. there were no line of sight effects?
2. we observed (as is more realistic) several waves behind each other because we look through a large part of the solar atmosphere?

Corona

A

Run through the same calculations as in the loop example of the notes on coronal loops, and repeat the calculations for a loop with the same characteristics, except now the temperature is only 500.000 K. How does the loop cool now?

B

the calculations for the change in temperature with time for the loop can be written as a function of the temperature T only under the assumptions made in the example. Plot this function for the loop in the example of the notes on coronal loops and plot the result as a function of temperature. What does this plot tell you?

C

At what temperature does the loop cool as much by radiation as by conduction?

Solar wind

A

Determine the constant integration constant C mentioned in the notes on the solar wind. (assume that $u(r_c) = u_c$).

B

Calculate the velocity of the solar wind at 1 AU (the orbit of earth), when the temperature $T = 500.000$ K, 1 million K, and 4 million K. Assume that the critical radius is at 5 $R_\odot$.