Exercise session 6

Friday Oct 8, 2021

Problems with odd numbers will be solved in class

1- Show that the group velocity can be written as:

$$v_G = \frac{c}{n} + \frac{\lambda c}{n^2}\frac{dn}{d\lambda}$$

2- Given the dispersion relation $\omega = ak^2$, compute both the phase and group velocities. (Solution: $v = ak, v_G = 2ak = 2v$)

3- An ionized gas or plasma is a dispersive medium for EM waves. Given that the dispersion equation is $\omega^2 = {\omega_P}^2 + c^2k^2$, where ω_P is the constant plasma frequency, determine expressions for both the phase and the group velocities and show that $vv_G = c^2$.

4- Determine the group velocity of waves when the phase velocity varies inversely with wavelength. (Solution: $v_G = \frac{2a}{\lambda}$)

5- A filter passes light with a mean wavelength of λ = 500 nm. If the emerging wavetrains are roughly 20λ_0 long, what is the frequency bandwidth of the exiting light? (Solution: $3*10^{14}$ Hz)

Q&A session