

Helicon Waves (Whistler waves II)

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- Structure of helicon/whistler waves
- Launching with antennas (Helicon sources)
- Plasma sources

R (electron branch)

$$N_{\perp} = 0 \quad N_{\parallel}^2 \approx 1 - \frac{\pi e}{(\omega + \Omega_e)(\omega + \Omega_i)} \quad \pi e = \sqrt{\frac{ne^2}{\epsilon_0 m_e}}$$

$$N = \frac{ck}{\omega} \quad \swarrow \quad N_{\parallel} = \frac{ck_{\parallel}}{\omega}$$

$$\begin{pmatrix} S - N^2 & -iD & 0 \\ iD & S - N^2 & 0 \\ 0 & 0 & P \end{pmatrix} \begin{pmatrix} E_x \\ E_y \\ E_z \end{pmatrix} = 0$$

$$S = \frac{R+L}{2}$$

$$D = \frac{R-L}{2}$$

only if $N_{\perp} = 0$

along $\underline{\beta}$

$\underline{\beta}$ is in \underline{z}

$$P E_z = 0 \quad P \neq 0 \Rightarrow \underline{E}_z = 0$$

$$(S - N^2) E_x = iD E_y$$

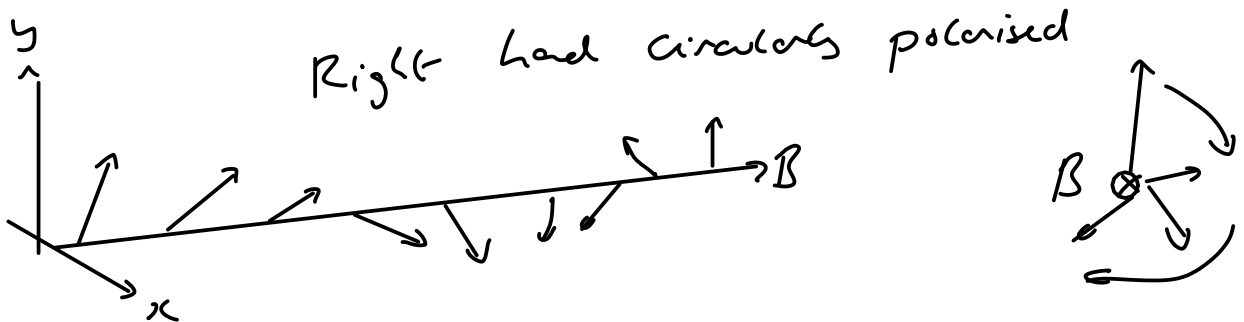
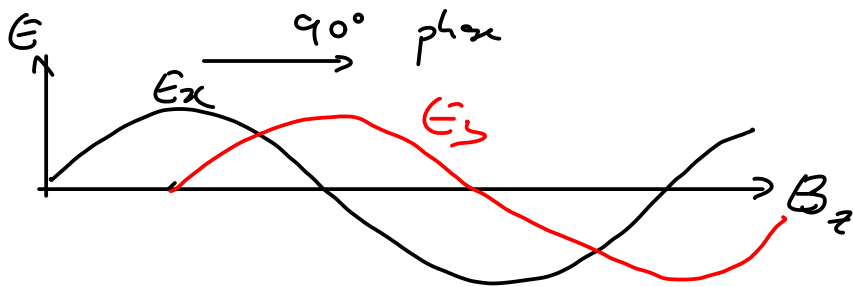
$$\frac{iE_y}{E_x} = \frac{S - N^2}{D} = \pm 1$$

Whistler $(S - N^2)^2 - D^2 = 0$

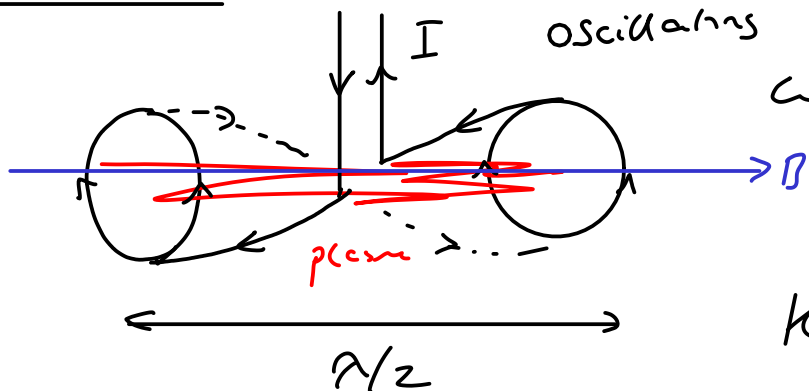
$$S - N^2 = \pm D$$

$$\left| \frac{iE_y}{E_x} = \pm 1 \right.$$

E_y, E_x 90° out of phase



Helicon antennae



$$\omega = -c^2 k_{||}^2 \frac{\mu e}{\pi e^2}$$

$$k = \frac{2\pi}{\lambda}$$

