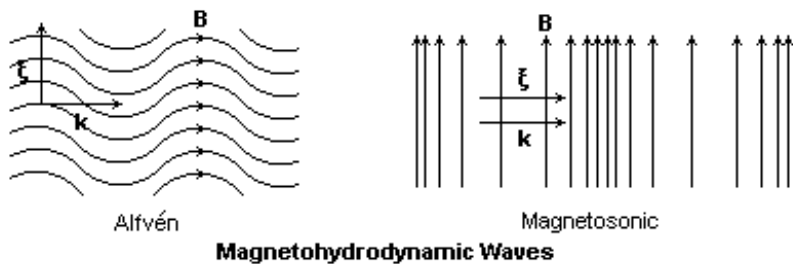
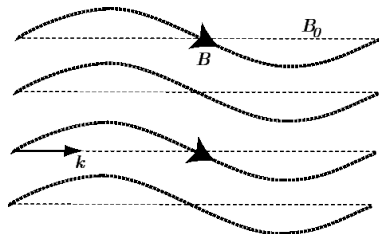


# Shear Alfvén and magnetosonic waves



- ▶ *Left:* Shear Alfvén waves propagating parallel to  $\mathbf{B}_0$ 
  - ▶ The displacement  $\xi$  is orthogonal to  $\mathbf{B}_0$  and  $\mathbf{k}$
  - ▶ These are **transverse** waves
- ▶ *Right:* A magnetosonic wave propagating orthogonal to  $\mathbf{B}_0$ 
  - ▶ The displacement  $\xi$  is parallel to  $\mathbf{k}$  but orthogonal to  $\mathbf{B}_0$
  - ▶ These are **longitudinal** waves

# Properties of the shear Alfvén wave



- ▶ The dispersion relationship is  $\omega^2 = k_{\parallel}^2 V_A^2$
- ▶ The wave is **transverse**
- ▶ The restoring force is **magnetic tension**
- ▶ No propagation orthogonal to  $\mathbf{B}_0$
- ▶ The displacement vector  $\boldsymbol{\xi} = \xi_x \hat{\mathbf{x}}$  is orthogonal to both  $\mathbf{B}_0 = B_0 \hat{\mathbf{z}}$  and  $\mathbf{k} = k_{\perp} \hat{\mathbf{y}} + k_{\parallel} \hat{\mathbf{z}}$
- ▶ Shear Alfvén waves are **incompressible**
  - ▶ Since  $\mathbf{k} \cdot \boldsymbol{\xi} = 0$ , the linearized continuity and energy equations show that both  $\rho_1$  and  $p_1$  are 0