

# Evolution of $B - \nabla \cdot \text{roj } B$

Plasma without motion, finite resistivity  $\eta$

$$\vec{B} \parallel \hat{z} \quad B = B_0 + B_1 \cos kx$$

$$\mu \vec{j} = \vec{E} + \vec{v} \times \vec{B} = \vec{E}$$

$$\frac{\partial \vec{B}}{\partial t} = - \text{curl}(\mu \vec{j})$$

$$\text{curl } \vec{B} = \mu_0 \vec{j} \Rightarrow \vec{j} \parallel \hat{y}$$

$$k B_1 \sin kx = \mu_0 j$$

$$\frac{\partial B_1 \cos kx}{\partial t} = - \mu \frac{\partial j}{\partial x} = - \mu \frac{k^2 B_1}{\mu_0} \cos kx$$

$$\frac{\partial B_1}{\partial t} = - \frac{\mu k^2}{\mu_0} B_1$$

$$B_1 = B_1(t=0) e^{-\frac{\mu k^2}{\mu_0} t}$$