Resistive Wall Modes

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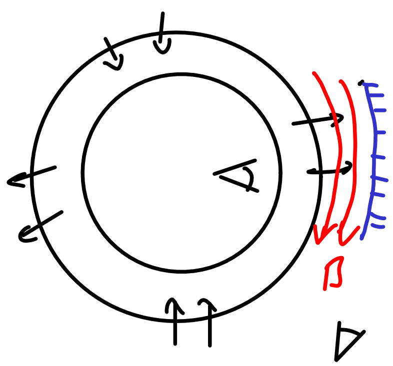

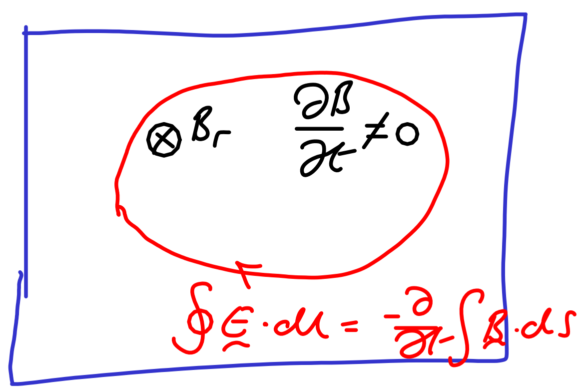

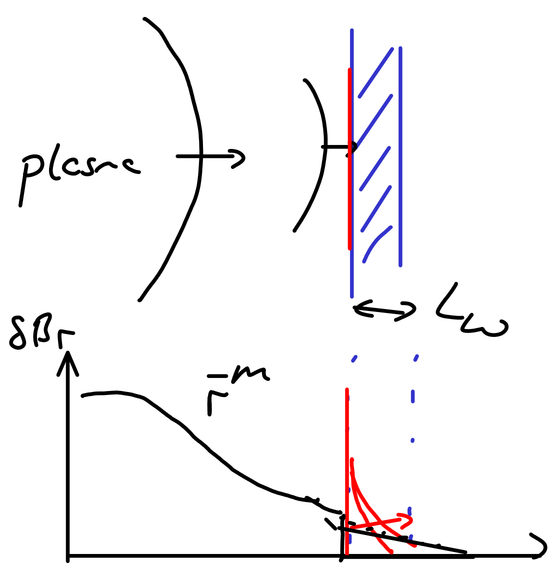

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

$$E = \eta J \quad \text{ohm's law}$$

$$\nabla \times B = \mu_0 J$$

$$\nabla \times \frac{\eta}{\mu_0} \nabla \times B = -\frac{\partial B}{\partial t}$$

$$-\nabla^2 B \frac{\eta}{\mu_0} = -\frac{\partial B}{\partial t}$$

$$\frac{\partial B}{\partial t} = \frac{\eta}{\mu_0} \nabla^2 B$$

$$\uparrow \qquad\qquad \uparrow$$

$$\sim \frac{1}{\tau_w} \qquad \sim \frac{1}{L_w}$$

$$\tau_w = \frac{L_w^2 \mu_0}{\eta}$$

Rotation reduces the rate of diffusion into the wall ~ 10s of ms

- if $\Omega \gg \frac{1}{\tau_w}$ ⇒ wall ~ superconducting

Mode Locking

Wall resistivity dissipates energy
- comes from plasma rotation

$$\frac{d\Omega}{dt} \propto \frac{\Omega \tau_w B_r^2}{1 + \Omega^2 \tau_w^2}$$

$\longrightarrow 0$ as $\Omega\tau \gg 1$

$\sim \Omega \tau_w B_r$ if $\Omega\tau \ll 1$