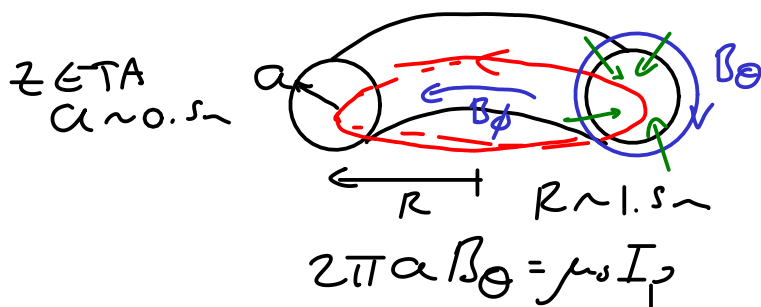


# Taylor relaxation

## Contents

- Toroidal pinches (ZETA)
- Quiescent periods
- Taylor's conjecture
- Solution in large aspect ratio

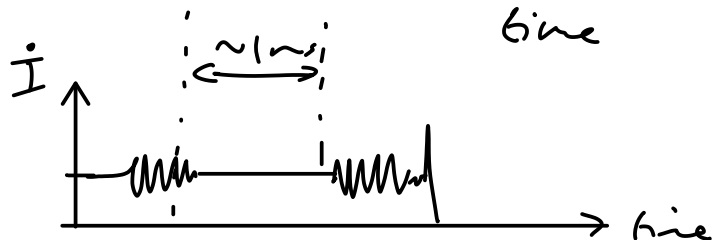
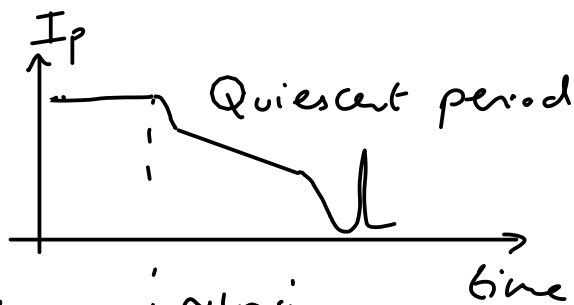
## Toroidal pinches



Pinch parameter

$$\Theta = \frac{B_\theta}{B_\phi}$$

$$\Theta = \frac{\mu_0 \bar{I}_p}{2\pi a B_\phi}$$



Helicity conserved

Toroidal flux conserved

Relaxation with globally conserved helicity

$\Rightarrow$  Force free field  
(Woltjer's theorem)

# Large aspect ratio

$B_r = 0$  ← Bessel functions

$B_\theta = \alpha J_1(\mu r)$

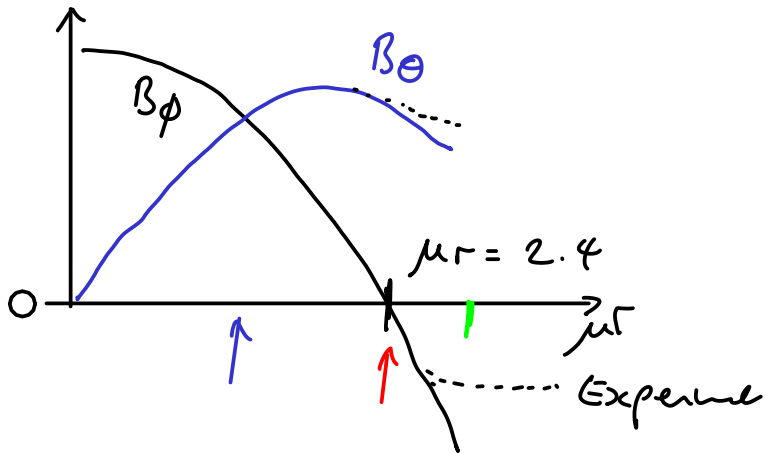
$B_\phi = \alpha J_0(\mu r)$

$\mu, \alpha$  constants

related  $\mu$

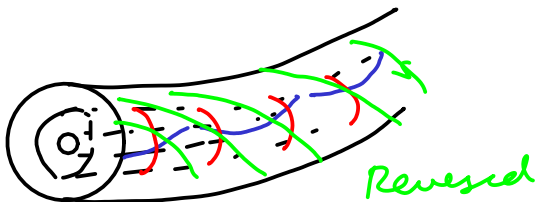
→  $\Theta$

pinch parameter



if  $\mu a > 2.4$

⇒ field reversed



$\Theta \geq 1.2$

⇒ plasma relaxes

to reversed field configuration

Lorenzini et al Nature Phys.  
5 (2009), 570

SHAx configuration

Reversed Field Pinches

(RFP)

Bodin, Newton Nuclear Fusion 20 (1980) 1255