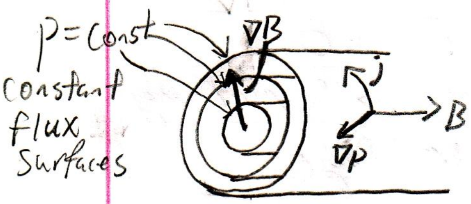
Mirror

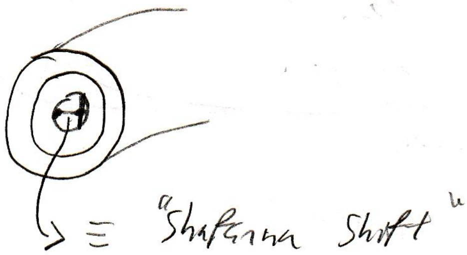
stabilize against bell curvature-

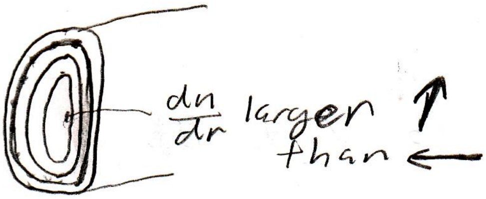
Ioffe bars - baseball seams → Ying Yang coil

Velocity space instability → loss cone instability →
flowing a cold plasma through the device
via loss cone region



$B \sim \frac{1}{R}$

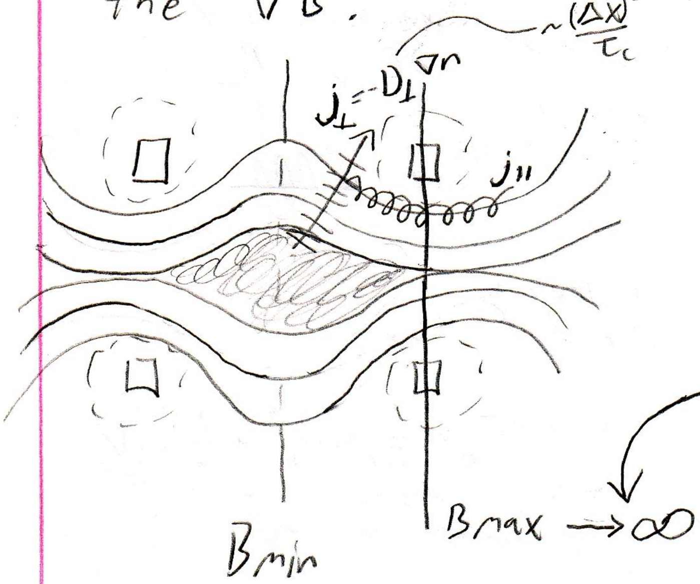




$j_\perp \sim -D_\perp \frac{\partial n}{\partial r}$

mag field = nkT
constant on surface

Think of plasma in B field as composed of many constant flux surfaces. These vary radially with the ∇B.



$\tau_\parallel < \tau_\perp$
ignore $j_\perp$

confinement time will be greater; not practical if compared with torus.

if ← but ←

→Torus-like

$n\tau \sim (n\tau)_{TOK}$

Why do less? - if only one loss
high $n\tau$, make device smaller because its simple.
Use exhaust from loss cone → Direct conversion to momentum (thrust) or to electricity

Fusion Rocket

adjust lofte bars to get net flow in one direction.

cone exhaust → Shaped nossle → use for thrust (momentum)

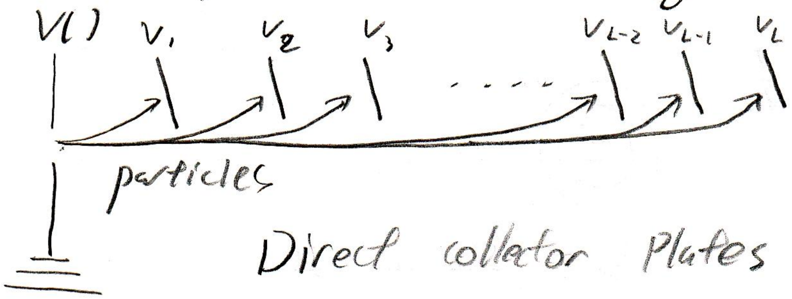
"losses" no longer become losses.

To Thrust

"loss cone in Tokamak" - Diverter brought field lines out could force into a nossle and create trust.

Not practical too big!

To electricity



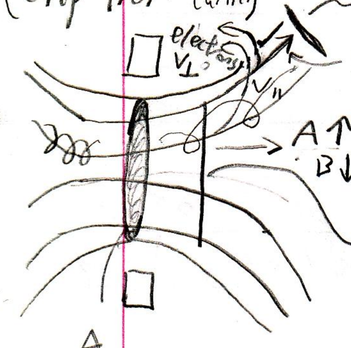
Direct collator Plates

KE → 0

PE → Something voltage

$\mu = \frac{\frac{1}{2} m v_\perp^2}{B}$ = constant

(Clip from earlier)



want $V_\parallel$ = max

$V_\perp \to 0$

→ $V_\perp$ ↓

B μ ↓ (μ constant)

so $V_\perp$ ↓ B↓

A↑ $V_\perp$↓

B·A = constant — A↑ B↓

How do we separate electrons from ions?

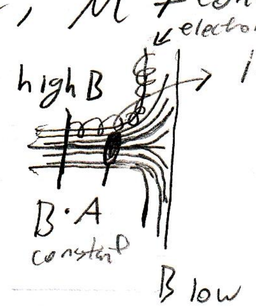
μ = constant

$\frac{\partial B}{\partial z} << \frac{B}{r_g}$

mag moment is an approx constant

By violating adiabatic invariance, ie, μ ≠ constant

$\frac{\partial B}{\partial z} \to$ large



→ ion leaving the field line

$M_e < M_i$

lower moment, thus easier follow field lines.

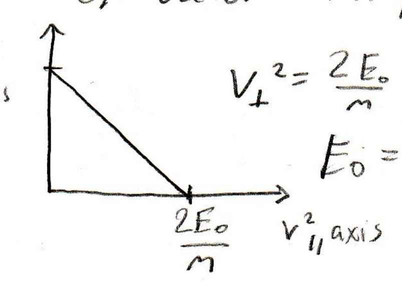
electrons

Constant → $E_0 = \frac{1}{2} m v_\parallel^2 + \frac{1}{2} m v_\perp^2$

components of vector velocity

$E_0 = \frac{1}{2} m (v_\parallel^2)_{max} + \mu B_{min}$

condition for reflection $v_\parallel \big|_{B \leq B_{max}} = 0$



$V_\perp^2 = \frac{2E_0}{m} - V_\parallel^2$

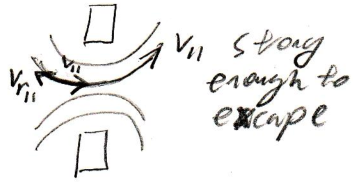
$E_0 = \frac{1}{2} m v_\parallel^2 + \mu B$

$\mu \equiv \frac{\frac{1}{2} m v_\perp^2}{B}$

Distribution of $V_{\parallel}$:

some stay in

some get out



$E_0 \le \mu B_{max}$

$\frac{1}{2}m(v_{\parallel}^2)_{max} + \mu B_{min} \le \mu B_{min}$

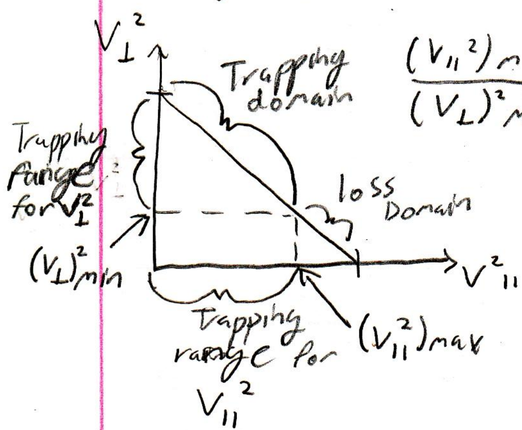
$V_{\perp}$ 1 degree of freedom

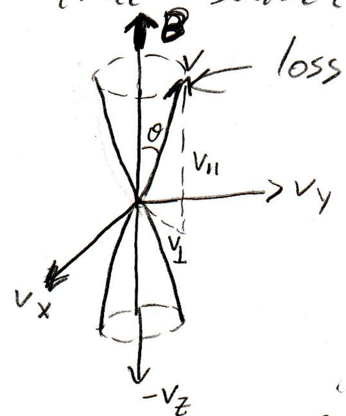
$V_{\parallel}$ ↖ 2 degrees of freedom

Ideally Maxwellian

$$\frac{\frac{1}{2}m(v_{\parallel}^2)_{max}}{\mu B_{min}} \le \frac{B_{max}}{B_{min}} - 1$$

particles will not escape loss cone region if true statement





loss cone instability

all at once

scattering of trapped particles