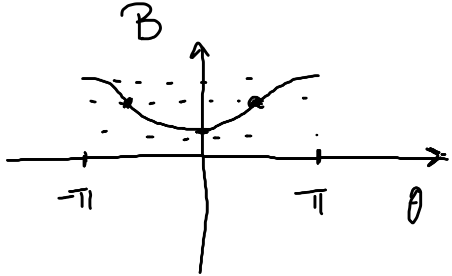


$$V_{eff} = \mu B$$

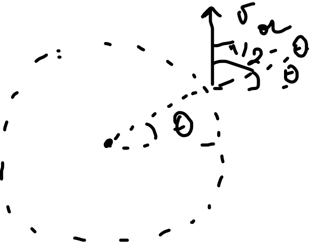
$$B = \frac{B_0 R_0}{R}$$

R_0: machine radius

$$\frac{v_{\parallel 0}}{v_{\perp 0}} \lesssim \sqrt{2\varepsilon}$$

$$R = R_0 + r\cos\theta \qquad \varepsilon = r/R_0$$

$$B = \frac{B_0 R_0}{R_0 + r\cos\theta} = \frac{B_0}{1+\varepsilon\cos\theta} \approx B_0(1 - \varepsilon\cos\theta)$$



Drift velocity is vertical

$$\dot{r} = v_d \,\mathrm{sen}\,\theta$$

$$v_d = \cancel{v_{d_{centrif}}} + v_{d_{\nabla|\underline{B}|}} \approx v_{d_{\nabla|\underline{B}|}}$$

$$\propto v_\parallel^2 \qquad \propto v_\perp^2$$

$$\frac{v_\parallel}{v_\perp} < \sqrt{2\varepsilon} \Rightarrow v_\parallel \ll v_\perp$$

$$v_{d_{\nabla|\underline{B}|}} \approx \frac{\mu \underline{\nabla}|\underline{B}| \cdot B}{qB^2} \approx \frac{\mu \,\cancel{B^2}/R}{q\,\cancel{B^2}}$$

$$\approx \frac{m v_\perp^2}{2BRq}$$

$$\dot{r} \approx \frac{m v_\perp^2}{2BRq}\,\mathrm{sen}\,\theta$$

$\dot{v}_{\parallel} = ?$

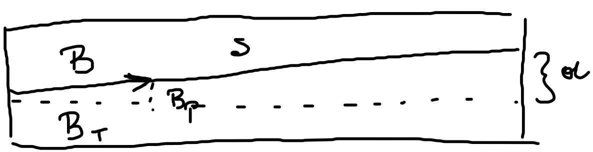
$$m\dot{v}_{\parallel} = -\mu\frac{\partial B}{\partial s} = -\mu\frac{\partial B}{\partial \theta}\cdot\frac{\partial \theta}{\partial s}$$

s: coordinate along the field line

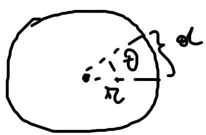
$$B = B_0(1-\varepsilon\cos\theta) \qquad \frac{\partial B}{\partial \theta} = B_0\,\varepsilon\sin\theta$$

Cylindrical approx

$$\frac{d}{s} = \frac{B_p}{B}; \quad d = \frac{B_p}{B}\cdot s$$



$$\theta = \frac{d}{r} = \frac{B_p\cdot s}{B}\cdot\frac{1}{r}$$



$$i = d/r$$

$$\frac{\partial \theta}{\partial s} = \frac{B_p}{rB}$$

$$\dot{v}_{\parallel} \approx -\frac{1}{m}\mu \frac{\partial B}{\partial \theta}\frac{\partial \theta}{\partial s} = -\frac{1}{\cancel{m}}\frac{\cancel{m} v_\perp^2}{2B}\cancel{B_0}\varepsilon \sin\theta \frac{B_p}{r\cancel{B}}$$

$$\varepsilon \to r/R_0$$

$$B \approx B_0 \qquad \frac{dv_{\parallel}}{dt} \approx -\frac{v_\perp^2 B_p \sin\theta}{2RB} \quad (1)$$

$$\dot{r} = \frac{dr}{dt} \approx \frac{m v_\perp^2}{2BRq}\sin\theta \quad (2)$$

$$(1)/(2) \qquad \frac{dv_{\parallel}}{dr} \approx -\frac{\cancel{v_\perp^2} B_p \cancel{\sin\theta}}{2\cancel{R}\cancel{B}} \cdot \frac{2\cancel{R}\cancel{B}q}{m\cancel{v_\perp^2}\cancel{\sin\theta}} \approx -\frac{B_p q}{m}$$

$v_{\parallel}$? r

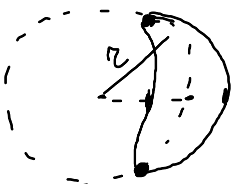
$$\int_{v_{\parallel}}^{0} dv_{\parallel} \approx -\frac{qB_p}{m}\int_{r}^{r_{TP}} dr \;; \quad 0 - v_{\parallel} = -\frac{qB_p}{m}(r_{tp} - r) \;;$$

$$v_{\parallel} \approx \frac{qB_p}{m}(r_{Tp} - r);$$

$$\boxed{r \approx -\frac{m}{qB_p} v_{\parallel} + r_{Tp}}$$

$$\Delta = \frac{m v_{\parallel}}{qB_p}$$

If $v_{\parallel} = 0 \Rightarrow r = r_{Tp}$



Displacement Δ is maximum when $v_{\parallel}$ is maximum

$$\Delta_{trapp} = \frac{m v_{\parallel}}{qB_p} \approx \frac{m\sqrt{2\varepsilon}\, v_{\perp 0}}{qB_p} \approx r_{L,p} \cdot \sqrt{2\varepsilon}$$

at most

$\varepsilon \ll 1$

$\sqrt{\varepsilon} > \varepsilon$

$$\Delta_{passing} \approx \varepsilon \cdot r_{Lp}$$

$$\frac{v_{\parallel 0}}{v_{\perp 0}} < \sqrt{2\varepsilon}$$

$$\Delta_{trapp} > \Delta_{passing}$$