Physics 142 - October 13, 2005

Magnetism

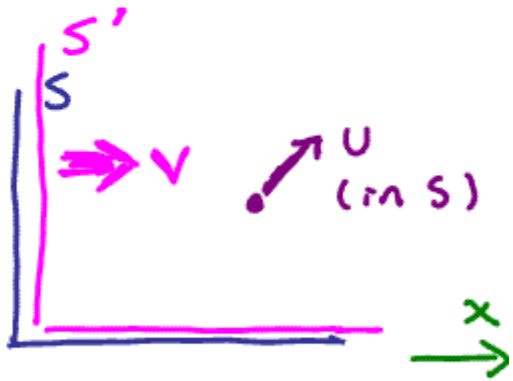
need project Groups

Applets, PRS

TA Evaluations

Monday Workshop

C = 1 units



Last time -

Lorentz Transformations between inertial frames of reference

$$x' = \gamma(x - vt) \qquad x = \gamma(x' + vt')$$
$$y' = y \qquad y = y'$$
$$z' = z \qquad z = z'$$
$$t' = \gamma\left(t - \frac{v}{c^2}x\right) \qquad t = \gamma\left(t' + \frac{v}{c^2}x'\right)$$

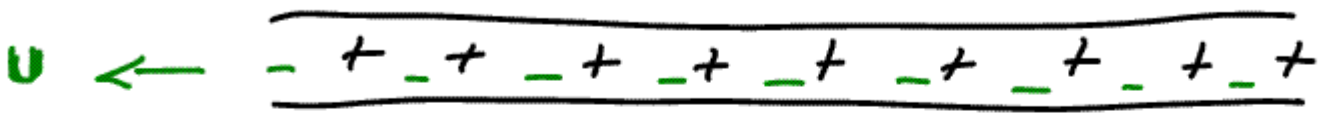
Relativistic velocity TRANSformations

$$u_x' = \frac{\gamma (u_x - v)}{\gamma \left(1 - \frac{v}{c^2} u_x\right)}$$

$$u_y' = \frac{u_y}{\gamma \left(1 - \frac{v}{c^2} u_x\right)}$$

$$u_z' = \frac{u_z}{\gamma \left(1 - \frac{v}{c^2} u_z\right)}$$

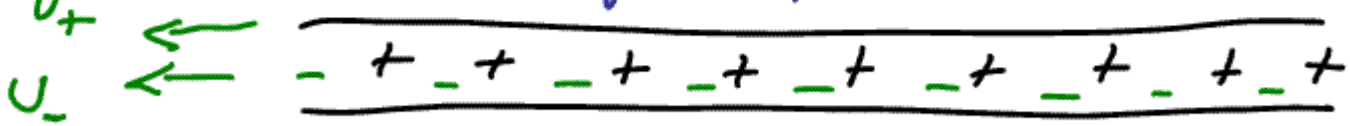
Relativity and E+M



$\lambda_- \approx \lambda_+$

q_0 no NeT $\vec{E}$, No force

go to reference frame where you aRe Moving Right wJ v

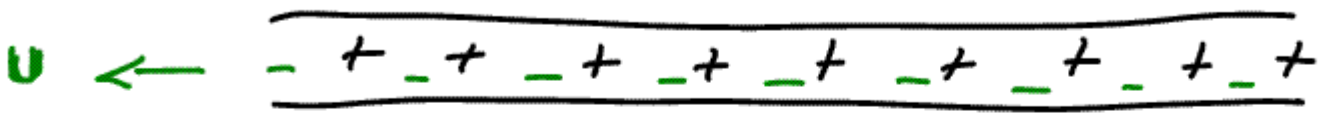


$|v_-| > |v_+|$

$\lambda_- \not\approx \lambda_+$

now you will see an Electric force

Relativity and E+M



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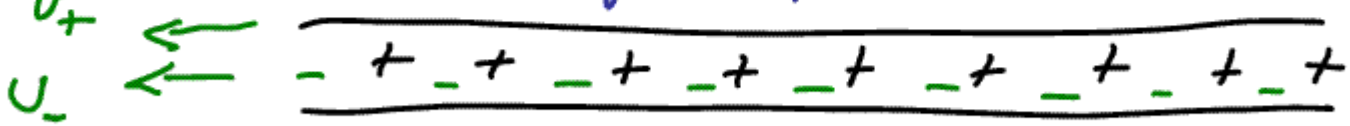


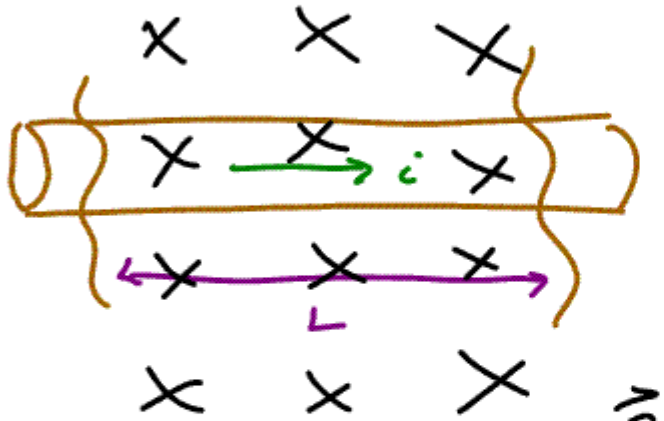
$|v_-| > |v_+|$

$\lambda_- \not\approx \lambda_+$

now you will see an Electric force

$$\vec{A} \times \vec{B} = \hat{i}(A_y B_z - A_z B_y) - \hat{j}(A_x B_z - A_z B_x) + \hat{k}(A_x B_y - A_y B_x)$$

Current in a wire



$\vec{B} \equiv$ Magnetic Field vector

$\vec{B}$

$$\vec{F}_{wire} = (q \vec{V}_d \times \vec{B}) \, n \, A \, L$$

$\vec{V}_d$: Drift Velocity

n: # charges / unit vol

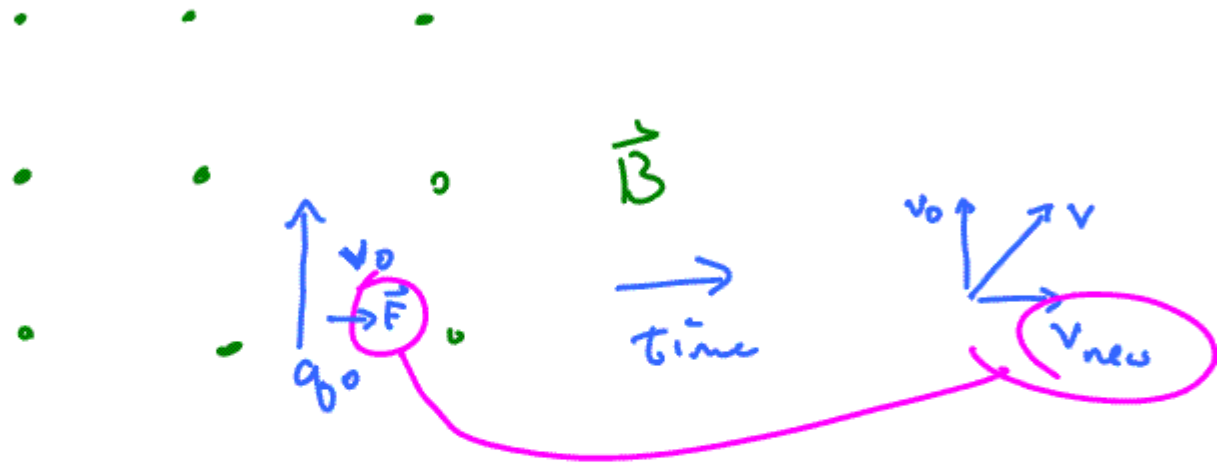
A: x sectional Area

$$i = n q v_d A$$

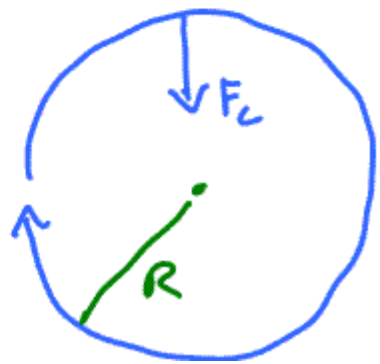
$$i \vec{L} \times \vec{B}$$

$$\vec{F}_{wire} = L \vec{i} \times \vec{B}$$

Charged particle Moving thru uniform $\vec{B}$ field



$\vec{F}$ always at $\perp$ to $\vec{v}$



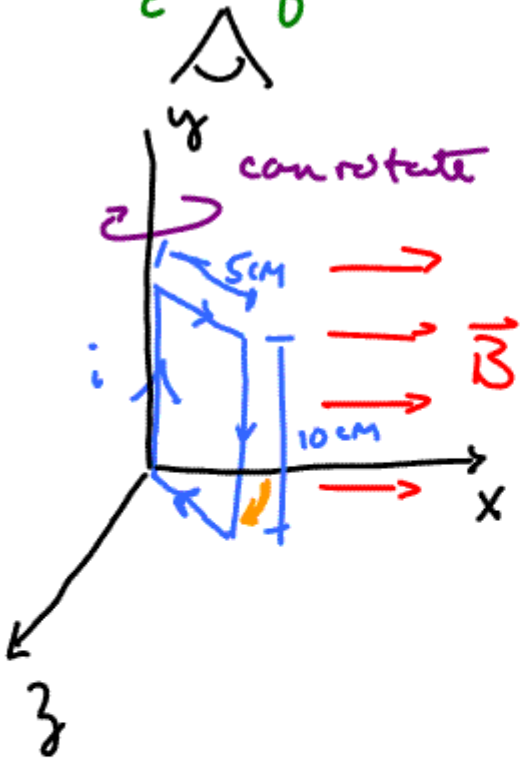
$$F_c = qvB = \frac{mv^2}{R}$$

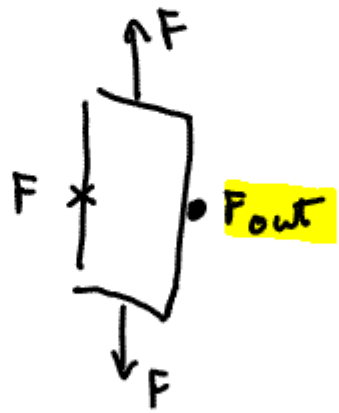
$$R = \frac{mv}{qB}$$

MKS unit of B

$i = 0.1$ A

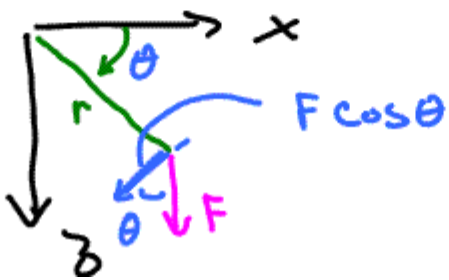
$B = 0.5$ Tesla





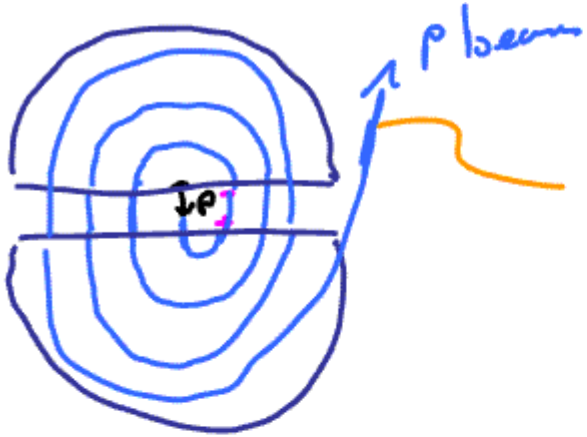
only force that Matters for rotation about y

Project into xz plane



$$\vec{\tau} = \underbrace{F}_{ilB} \cos\theta \; r \; (\text{down} = -\hat{y})$$

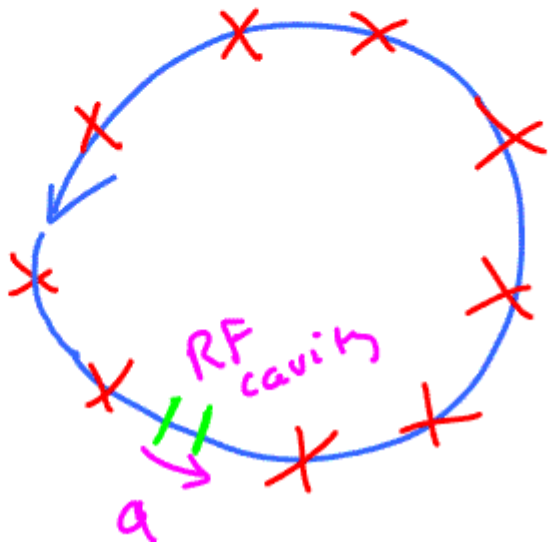
Particle Accelerators



Cyclotron

Magnet DEES

Synchrotron



$\vec{B}$ uniform But changing