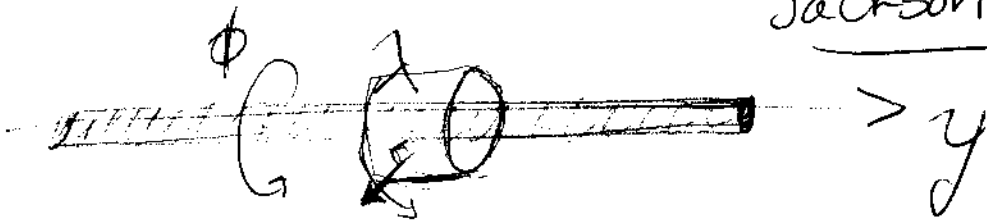


Problem #8 Fall 2001

Jackson (11.149)



a) $\int \vec{E} \cdot d\vec{a} = 4\pi Q_{enc}$
 $E 2\pi r l = 4\pi \lambda l$
 $|\vec{E}| = \frac{4\pi\lambda}{2\pi r} = \frac{2\lambda}{r}$

b) $\vec{E}_{\perp} = \gamma_0 \vec{E}'_{\perp}$

$$\gamma_0 = \frac{1}{\sqrt{1 - v_0^2/c^2}}$$

$$\vec{E} = \frac{2\lambda}{r\sqrt{1 - v^2/c^2}} \hat{r} = \frac{2\gamma\lambda}{r} \hat{r}$$

$$I = \lambda v \hat{y}$$

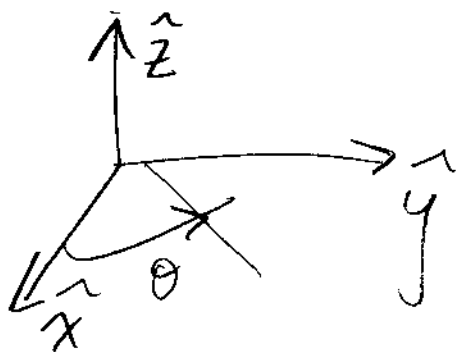
$$\vec{B}' = \gamma \left(\frac{\vec{v}}{c} \times \vec{E} \right) = \frac{v 2\lambda}{cr\sqrt{1 - v^2/c^2}} \hat{\phi}$$

$$\vec{B}' = \frac{2\gamma v \lambda}{cr} \hat{\phi}$$

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 better

$$\vec{E}' = \gamma (\vec{E} + \vec{\beta} \times \vec{B}) - \frac{\gamma^2}{\gamma + 1} \vec{\beta} (\vec{\beta} \cdot \vec{E})$$

$$\vec{\beta} = \frac{\vec{v}}{c}$$



$$\vec{B}' = \gamma (\vec{B} - \vec{\beta} \times \vec{E}) - \frac{\gamma^2}{\gamma + 1} \vec{\beta} (\vec{\beta} \cdot \vec{B})$$

let $\vec{\beta} = -\frac{v}{c} \hat{y}$, $\vec{B} = 0$

$$\boxed{\vec{E}' = \gamma \vec{E}} \quad \checkmark$$

$$\vec{B}' = -\gamma \vec{\beta} \times \vec{E} = \frac{\gamma v}{c} \vec{E} (\hat{y} \times \hat{r})$$

$$\boxed{\vec{B}' = \frac{\gamma v E}{c} \hat{\phi}} \quad \checkmark$$