RAD PROC. - HW19

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10/6/23

1.) Given $E_0 = \frac{q}{b^2}$, $t_0 = \frac{b}{\gamma v}$ ——— (1)

~~Given~~ $E_x = \frac{-q v \gamma t}{(\gamma^2 v^2 t^2 + b^2)^{3/2}}$ ——— (2) (1.)

$$= \frac{-q v \gamma t}{b^3 \left(\frac{\gamma^2 v^2 t^2}{b^2} + 1\right)^{3/2}} \quad (\text{using } (1))$$

$$= \frac{-\frac{q}{b^2} \cdot \frac{\gamma v}{b} \cdot t}{\left(\left(\frac{\gamma v}{b}\right)^2 t^2 + 1\right)^{3/2}} \quad (\text{using } (1))$$

$$= \frac{-E_0 (t_0)^{-1} t}{\left(\left(\frac{t}{t_0}\right)^2 + 1\right)^{3/2}}$$

{proven}

$$\Rightarrow \boxed{\frac{E_x}{E_0} = \frac{-t/t_0}{\left[1 + \left(\frac{t}{t_0}\right)^2\right]^{3/2}}}$$

$$E_y = \frac{q \gamma b}{(\gamma^2 v^2 t^2 + b^2)^{3/2}} = \frac{q \gamma \cancel{b} / b^{3\cancel{2}}}{\left(\frac{\gamma^2 v^2 t^2}{b^2} + 1\right)^{3/2}}$$

$$= \frac{\frac{q}{b^2} \cdot \gamma}{\left(\left(\frac{\gamma v}{b}\right)^2 t^2 + 1\right)^{3/2}} = \frac{E_0 \gamma}{\left[1 + \left(\frac{t}{t_0}\right)^2\right]^{3/2}} \quad (\text{using } (1))$$

{proven}

$$\Rightarrow \boxed{\frac{E_y}{E_0} = \frac{\gamma}{\left[1 + \left(\frac{t}{t_0}\right)^2\right]^{3/2}}}$$

$B_z = \beta E_y$

$$\therefore \boxed{\frac{B_z}{E_0} = \frac{\beta E_y}{E_0} = \frac{\beta \gamma}{\left[1 + \left(\frac{t}{t_0}\right)^2\right]^{3/2}}}$$