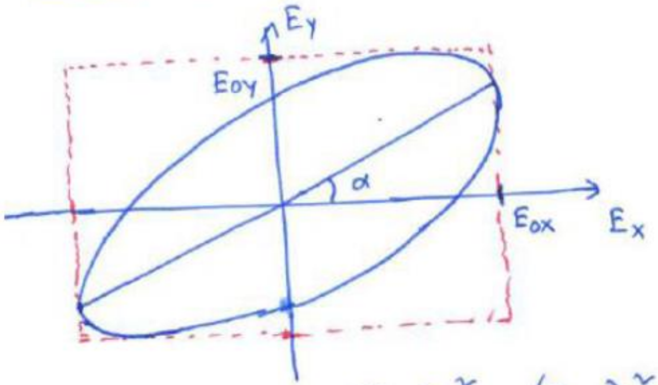
5.

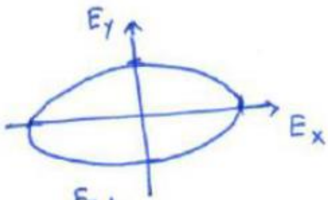
$$\boxed{\left(\frac{E_y}{E_{oy}}\right)^2 + \left(\frac{E_x}{E_{ox}}\right)^2 - \frac{2E_xE_y}{E_{ox}E_{oy}}\cos\delta = \sin^2\delta}$$

→ general eqn for an ellipse oriented at an angle α in the (E_x, E_y) plane

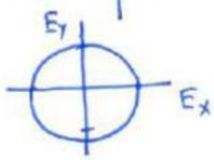


$$\tan 2\alpha = \frac{2E_{ox}E_{oy}\cos\delta}{E_{ox}^2 - E_{oy}^2}$$

$\delta = \pi/2 \Rightarrow \left(\frac{E_y}{E_{oy}}\right)^2 + \left(\frac{E_x}{E_{ox}}\right)^2 = 1$

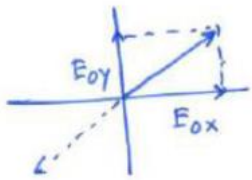


$\delta = \pi/2$, $E_{ox} = E_{oy} = E_0 \Rightarrow E_y^2 + E_x^2 = E_0^2$



circularly polarized

$\delta = 0$,



linearly polarized

6. **energy stored=energy flown out=** $\frac{1}{2}V\mu_0K^2$

7. $L = \frac{\mu_0 N^2 h}{2\pi}\ln\frac{b}{a}$; $W = \frac{1}{2}LI^2 = \frac{\mu_0 N^2 h I^2}{2\pi}\ln\frac{b}{a}$

8. a) $E \cdot 2\pi r = \pi r^2 \dot{B} \Rightarrow E = \frac{r}{2}\dot{B}$

Force on outer cylinder $-Q \cdot \frac{b}{2}\dot{B} \Rightarrow$ torque $= -\frac{Q}{2} b^2 \dot{B}$

Similarly torque on inner cylinder $= +\frac{Q}{2} a^2 \dot{B}$.

Total angular momenta imparted when $B=0$

$L = \int_{B_0}^{0} -\frac{Q}{2}(b^2-a^2)\dot{B}\,dt = \frac{QB_0}{2}(b^2-a^2)$, where $B_0 = \mu_0 n I$

b) In between the charged cylinders

$|\vec{E}| = \frac{\lambda}{2\pi\epsilon_0 r} = \frac{Q/L}{2\pi\epsilon_0 r}$ radially outward in xy plane

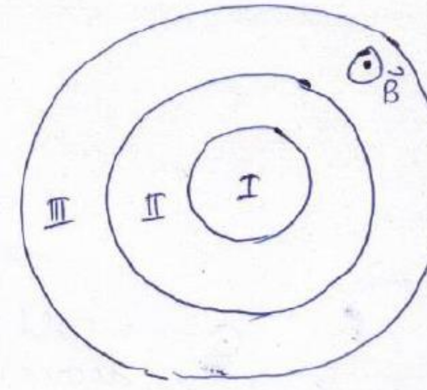
$|\vec{g}| = |\epsilon_0(\vec{E}\times\vec{B})| = \epsilon_0 \frac{Q/L}{2\pi\epsilon_0 r}\cdot \mu_0 n I$ → circumferential in xy plane

Angular momentum density $\vec{r}\times\vec{g}$ → pointing into the page

Total angular momentum

$$L = \int_a^b r \cdot \frac{Q}{2\pi L r}\cdot \mu_0 n I \; 2\pi r\,dr\,L$$

$$= Q\mu_0 n I \int_a^b r\,dr = \frac{QB_0}{2}(b^2-a^2)$$



I, II, III $\vec{B} = \mu_0 n I \hat{z}$

I → $\vec{E} = 0$

II → $\vec{E} \neq 0$, radially outward in xy plane

III → $\vec{E} = 0$

$\vec{L}$ is nonzero only in II

↳ field angular momentum