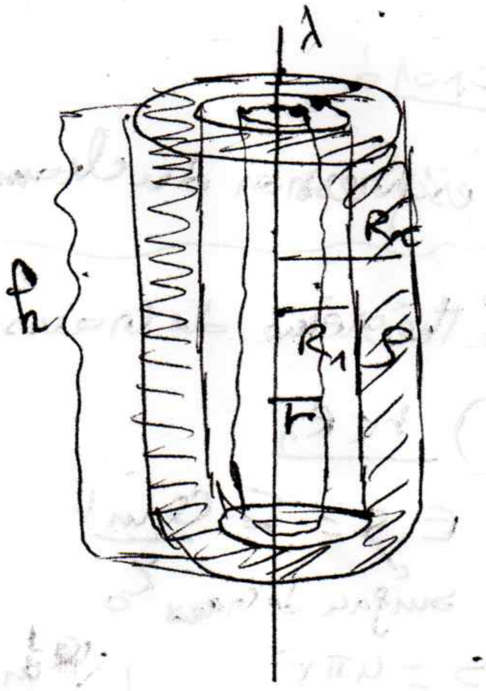
Exo2 ;

Le champ électrostatique $\vec{E}(M)$:



- $r < R_1$

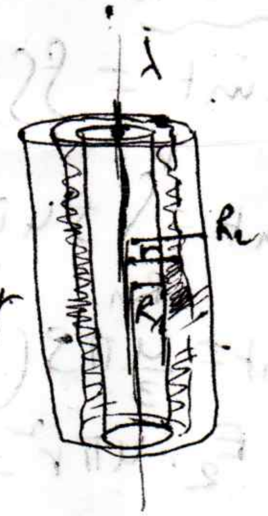
$$E_1 . S = \frac{\Sigma Q_{int}}{\varepsilon_0}$$

$S = 2\pi r h$ → surface de Gauss

$$\Sigma Q_{int} = \int_{(h)} \lambda \, dl = \lambda h$$

$$E_1 . 2\pi r h = \frac{\lambda h}{\varepsilon_0} \Rightarrow E_1 = \frac{\lambda}{2\pi r \varepsilon_0}$$

- $R_1 < r < R_2$



$$\Sigma Q_{int} = \lambda h + \iiint \rho \, dV$$

$$= \lambda h + \int_{R_1}^{r} \rho \, 2\pi r h \, dr$$

$V = \pi r^2 h$
$dV = 2\pi r h \, dr$

$$\Sigma Q_{int} = \lambda h + \pi \rho h (r^2 - R_1^2)$$

$$E_2 . 2\pi r h = \frac{\lambda h + \pi \rho h (r^2 - R_1^2)}{\varepsilon_0}$$

$$E_2 = \frac{\lambda}{2\pi \varepsilon_0 r} + \frac{\rho (r^2 - R_1^2)}{2 \varepsilon_0 r}$$

- $r > R_2$:

$$\Sigma Q_{int} = \lambda h + \int_{R_1}^{R_2} \rho \, 2\pi r h \, dr$$

$$\Sigma Q_{int} = \lambda h + \pi \rho h (R_2^2 - R_1^2)$$

$$E_3 . 2\pi r h = \frac{\lambda h + \pi \rho h (R_2^2 - R_1^2)}{\varepsilon_0}$$

$$E_3 = \frac{\lambda}{2\pi r \varepsilon_0} + \frac{\rho (R_2^2 - R_1^2)}{2 \varepsilon_0 r}$$