Exo4

Expression du $\vec{E}(r)$

1) $r < R_1$:

$E_1 \cdot S_G = \frac{\sum q_i}{\xi_0}$

$S_G = 4\pi r^2$

$E_1 \cdot 4\pi r^2 = \frac{0}{\xi_0} \Rightarrow E_1 =$

$E_1 = 0$

2) $R_1 < r < R_2$

$E_2 \cdot 4\pi r^2 = \frac{\sum q_i}{\xi_0}$

$\sum q_i = \iiint \rho \, dV$

$V = \frac{4}{3}\pi r^3 \Rightarrow dV = 4\pi r^2 dr$.

$\sum q_i = \int_{R_1}^{r} \rho \, 4\pi r^2 dr = \frac{4}{3}\pi\rho r^3 \Big]_{R_1}^{r}$

$= \frac{4}{3}\pi\rho (r^3 - R_1^3)$

où : $\sum q_i = \rho \, dV = \rho (V_r - V_{R_1})$ (volume)

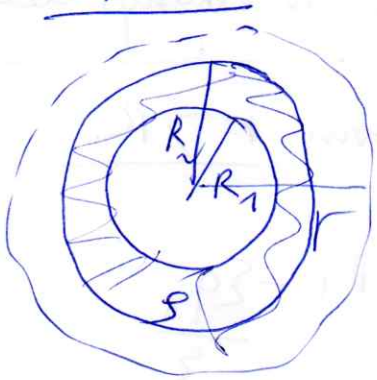
$= \rho \left(\frac{4}{3}\pi r^3 - \frac{4}{3}\pi R_1^3\right)$

Donc $E_2 \cdot 4\pi r^2 = \frac{\frac{4}{3}\pi\rho (r^3 - R_1^3)}{\xi_0}$

$E_2 = \frac{\rho}{3\xi_0 r^2}(r^3 - R_1^3)$

$E_2 = \frac{\rho}{3\xi_0}\left(r - \frac{R_1^3}{r^2}\right)$

3) $r > R_2$



$E_3 \cdot 4\pi r^2 = \frac{\sum q_i}{\xi_0}$

$\sum q_i = \iiint \rho \, dV$

$= \int_{R_1}^{R_2} \rho \, 4\pi r^2 dr$

$= \frac{4}{3}\pi\rho \left[r^3\right]_{R_1}^{R_2}$

$= \frac{4}{3}\pi\rho (R_2^3 - R_1^3)$

où : $\sum q_i = \rho \, dV = \rho (V_{R_2} - V_{R_1})$

$= \rho \left(\frac{4}{3}\pi R_2^3 - \frac{4}{3}\pi R_1^3\right)$

$= \frac{4}{3}\pi\rho (R_2^3 - R_1^3)$

Donc

$E_3 \cdot 4\pi r^2 = \frac{\frac{4}{3}\pi\rho (R_2^3 - R_1^3)}{\xi_0}$

$E_3 = \frac{\rho (R_2^3 - R_1^3)}{3\xi_0 r^2}$