(25) F15-

$$\Phi_E = \oiint \vec{E} \cdot d\vec{A}$$

$$\Phi_E = \frac{Q_{enc}}{\varepsilon_0}$$

ρ λ σ

$$Q_{enc} = \iiint \rho \, d^3r$$

$$\rho(r) = \frac{Q}{\frac{4}{3}\pi a^3} \cdot \frac{4}{3}\pi r^3 \Big) = 4\pi \int \rho(r) r^2 dr$$

$$d^3r = r^2 \sin\theta \, d\theta \, d\phi$$

$$Q_{enc} = \iiint \rho \, d^3r$$

$$= 4\pi \int \rho(r) r^2 dr$$

(1a) $Q = \iiint \rho \, d^3n$

$= 4\pi \int \rho \, d^3n \, r^2$ $\quad r^2 dr$

$\rho = C \cdot r$

$Q = 4\pi \int_0^a C \cdot r \cdot r^2 dr$

$= 4\pi C \int_0^a r^3 dr$

$= \pi C \left(\frac{a^4}{4}\right)$

$C = \frac{Q}{\pi\left(\frac{a^4}{4}\right)}$

$\rho = \frac{Q}{\pi\left(\frac{a^4}{4}\right)} \cdot r$

$\rho = C \cdot r$ (q) Q

$$Q = 4\pi \int_0^a C r \cdot r^2 dr$$

$$= 4\pi C \int r^3 dr \quad \int r^3 dr = \frac{r^4}{4}$$

$$= \pi C r^4 \Big|_0^a$$

$$= \pi C a^4 \quad C = \frac{Q}{\pi a^4}$$

$$\rho = \frac{Q}{\pi a^4} r$$

$$Q = \iiint \rho \cdot d^3 r$$

$\rho = \frac{\Phi}{\pi} r$ ⊙

Choose GS of radius r
Centered on charge

$\Phi_E = \frac{Q_{enc}}{\varepsilon_0}$ on GS: $\vec{E} \parallel \vec{A}$

$|\vec{E}|$ uniform

$$\Phi = \oiint \vec{E} \cdot d\vec{A}$$

$$= \oiint E \, dA$$

$$= E \oiint dA = E(4\pi r^2)$$

$$Q_{enc} = \iiint \rho \, d^3r \quad (\rho = Cr)$$

$$= 4\pi C \int_0^r r \, r^2 \, dr$$

$$E = \frac{\pi C r^4}{\varepsilon_0 (4\pi r^2)} = \frac{C r^2}{4\varepsilon_0} \hat{r}$$

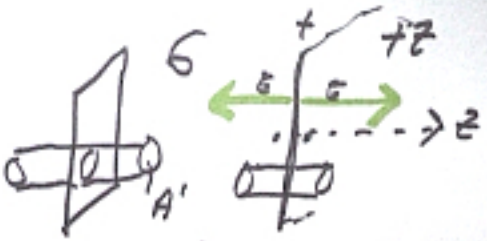
outside: $\oint_E = E(4\pi r^2)$

GS: $r > a$

$$Q_{enc} = \iiint \rho \, d^3r$$

$$= 4\pi \int_0^a C r \cdot r^2 dr$$

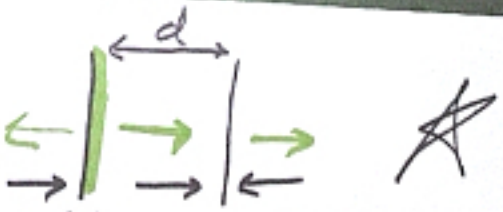
$$= Q \quad ; \; C = \frac{Q}{\pi(\text{eq 4})}$$

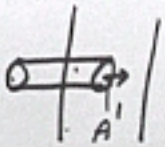


$$\Phi_E = \frac{Q_{enc}}{\varepsilon_0}$$

$$\Phi_E = 2EA' \qquad Q_{enc} = \sigma A'$$

$$2EA' = \frac{\sigma A'}{\varepsilon_0} \Rightarrow \vec{E} = \frac{\sigma}{2\varepsilon_0} \begin{cases} +\hat{z} : z > 0 \\ -\hat{z} : z < 0 \end{cases}$$





$\Phi_E = EA'$ $\quad Q_{enc} = \sigma A'$

$$EA' = \frac{\sigma A'}{\varepsilon_0} \Rightarrow \vec{E} = \frac{\sigma}{\varepsilon_0}\hat{\imath} \quad (0 < x < d)$$

0 otherwise