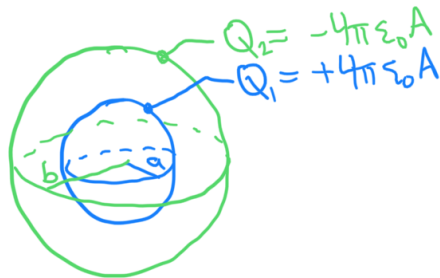


Recall the example,

$$\vec{E} = \begin{cases} \frac{A}{r^2} \hat{r}, & a < r < b \\ 0, & \text{elsewhere} \end{cases} \quad (A \text{ a constant})$$

$$V = \begin{cases} \frac{A}{a} - \frac{A}{b}, & r \leq a \\ \frac{A}{r} - \frac{A}{b}, & a < r < b \\ 0, & r \geq b \end{cases}$$



Find the energy of the charge configuration:

$$W = \frac{1}{2} \sum V dq = \frac{1}{2} [Q_1 V_1 + Q_2 V_2] \\ = 2\pi\epsilon_0 A \left[ \left( \frac{A}{a} - \frac{A}{b} \right) - 0 \right] = 2\pi\epsilon_0 A^2 \left( \frac{1}{a} - \frac{1}{b} \right)$$

Now consider the energy stored in the electric field:

$$W = \int \frac{1}{2} \epsilon_0 E^2 d\tau = \frac{1}{2} \epsilon_0 \int_a^b \left( \frac{A}{r^2} \right)^2 4\pi r^2 dr = 2\pi\epsilon_0 A^2 \left( \frac{1}{a} - \frac{1}{b} \right)$$

Since  $a < b$ , the energy is positive.

DISCUSS HOW THE SIGNS OF  $E_r$ ,  $V$ ,  $W$ ,  $Q$  WOULD BE AFFECTED BY CHANGING THE SIGN OF THE CONSTANT  $A$ .