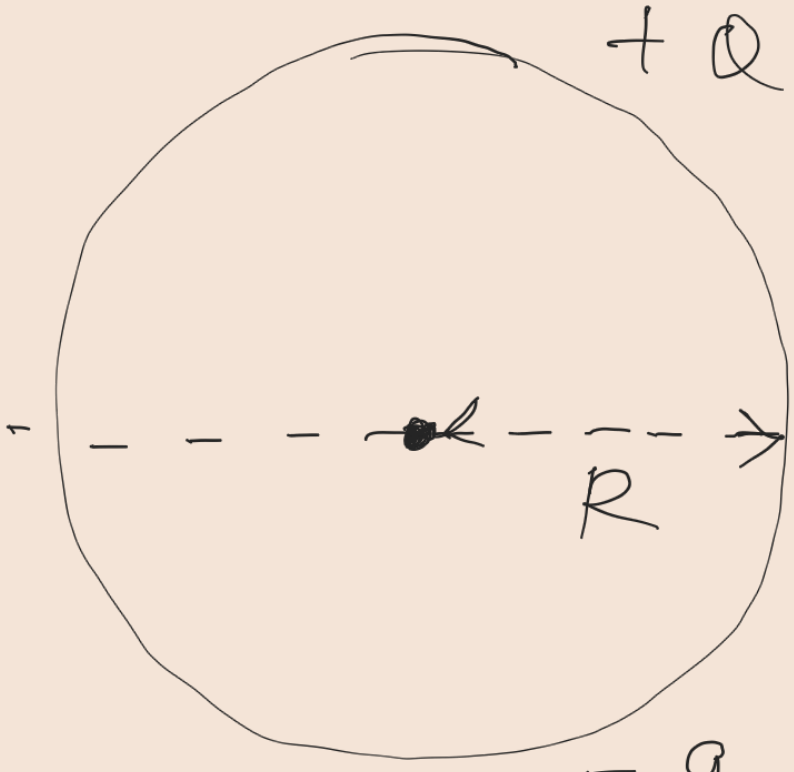


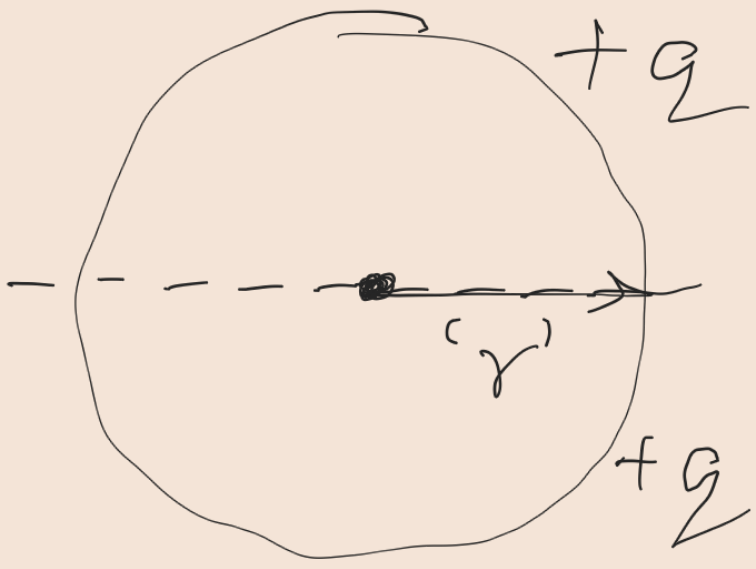
Let the self energy of '+Q' hemisphere be 'x'. Then, the self energy of '-q' hemisphere is $-\left(\frac{x}{Q}\right)(q)$. We can say that

$\cancel{\text{'}SE\text{'}_Q} + \text{'}SE\text{'}_{\cancel{(-q)}} + \text{''}$ interaction energy between 'Q & (-q)''

$+W = \left[\cancel{\text{'}SE\text{'}\ of\ \text{'}Q\text{'}}\right] + \left[\cancel{\text{'}SE\text{'}\ of\ (-q)}\right]$.

Now, lets take a

shell of charge (2q), distributed uniformly over the shell. Also, let



self energy of 'q' hemisphere is 'x'. Then,

$x + x +$ [interaction energy of 'q' hemisphere with another] $= \frac{k(2q)^2}{2r}$.

Now, interaction of 'Q' & 'q' hemisphere of radius 'R' is 'W', as

obtained from first eqn.
Then, by proportion, the interaction energy of 'q' & 'q' hemisphere of radius 'r' will be

$$\left[\frac{\left(\frac{W}{Q}\right)}{\left(\frac{1}{R}\right)}\right] \times (q) \times \left(\frac{1}{r}\right).$$

We should note that self energy is inversely proportional to radius, so the radius term is inversely divided &

multiplied. Hence,

$$2x + \frac{WQR}{Q\gamma} = \frac{Q^2}{2\pi\epsilon_0\gamma}$$

$$x = \frac{Q^2}{4\pi\epsilon_0\gamma} - \frac{WQR}{2Q\gamma}.$$