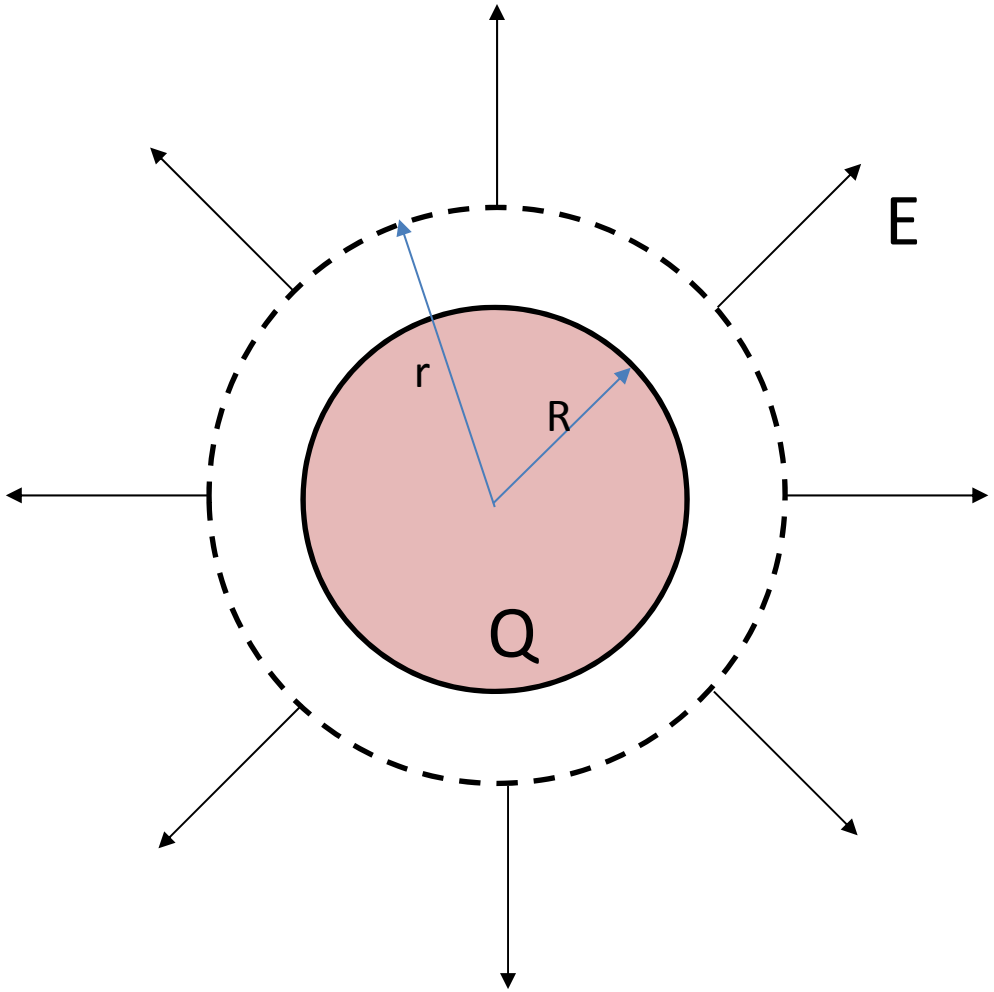
Class 7: More Gauss's Law

Uniform spherical distribution



For r>R

$$\varepsilon_0 \, \Phi_E = Q \;\Rightarrow\; \varepsilon_0 \cdot E \cdot 4\pi \, r^2 = Q$$

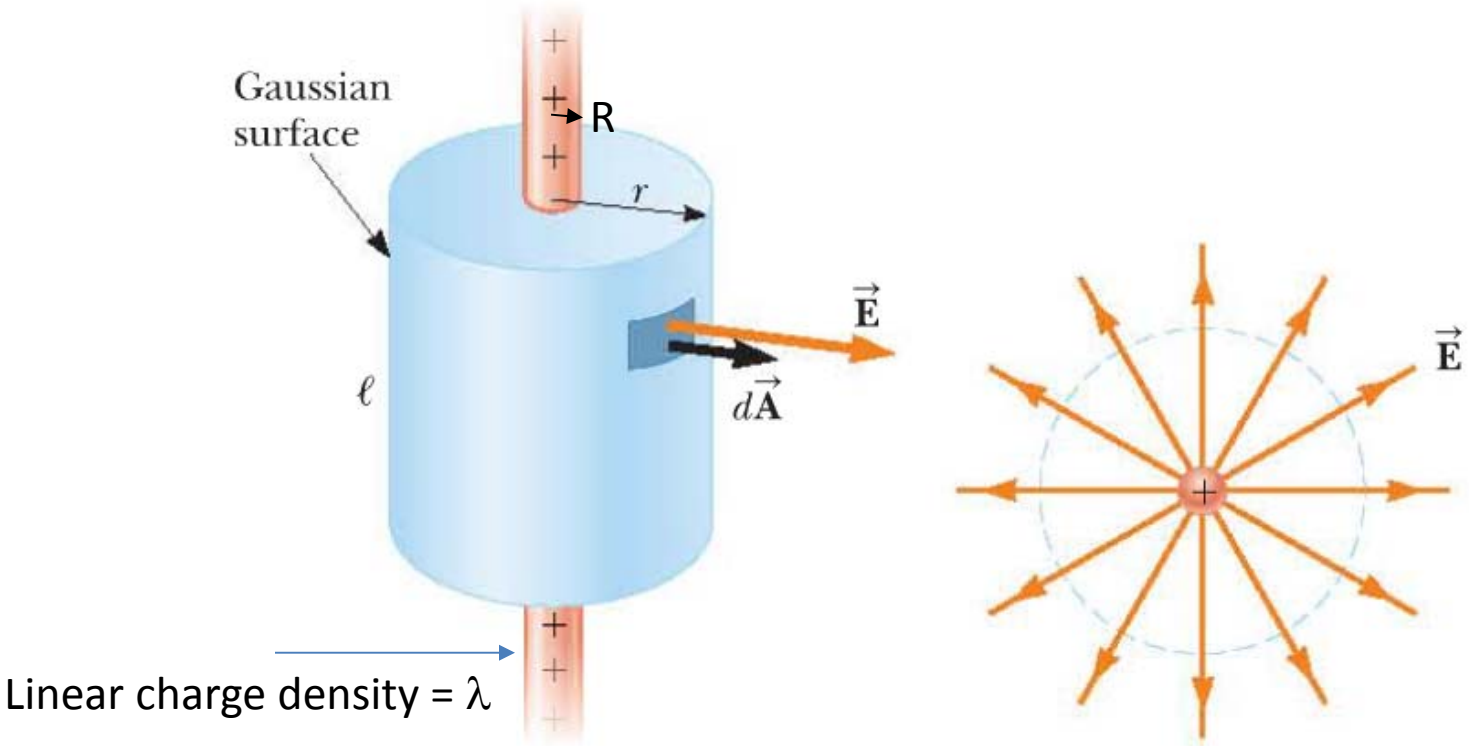
$$\Rightarrow\; E = \frac{Q}{4\pi\varepsilon_0 \, r^2}$$

Note that point charge belongs to this case.

For r<R

Depends on the actual charge distribution.

Uniform cylindrical (infinite long) distribution



For r>R $\varepsilon_0 \Phi_E = q_{in} \Rightarrow \varepsilon_0 \cdot E \cdot 2\pi r \ell = \lambda \ell$

$$\Rightarrow E = \frac{\lambda}{2\pi\varepsilon_0 r}$$

Note that a line point charge belongs to this case.

For r<R Depends on the actual charge distribution.