



INSTITUTO DE FÍSICA

uff Universidade Federal Fluminense

# Física XX

## Eletrostática

# Aula anterior

- Potencial elétrico.
- Cálculo de potencial elétrico de distribuição contínua.
- Relação entre campo elétrico e potencial elétrico.
- Cálculo do potencial a partir do campo elétrico.
- Cálculo do campo elétrico a partir do potencial.

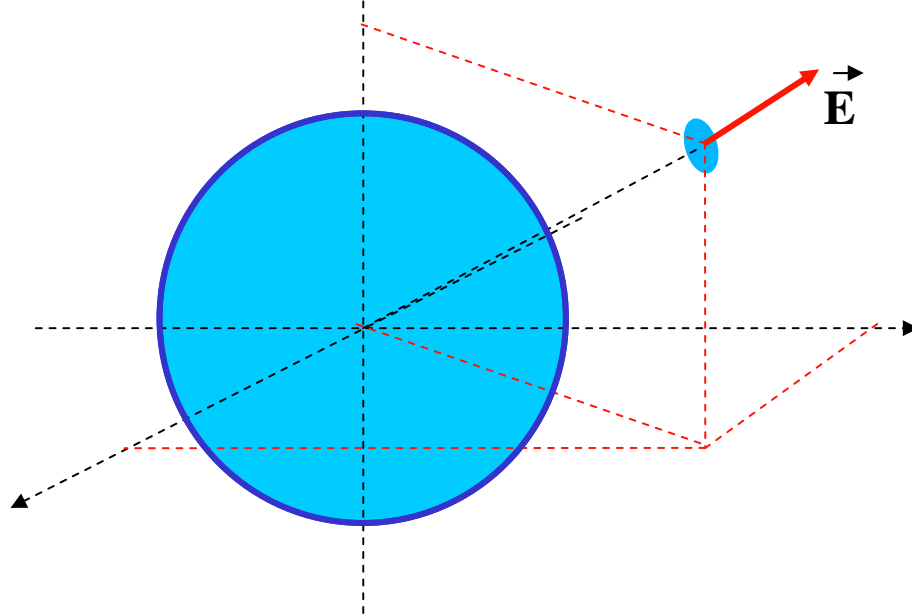
Relação entre campo elétrico e potencial elétrico

$$V_B - V_A = - \int_A^B \vec{E} \cdot d\vec{r}$$

$$E_x = - \frac{dV}{dx}$$

$$\vec{E} = - \left( \frac{dV}{dx} \hat{i} + \frac{dV}{dy} \hat{j} + \frac{dV}{dz} \hat{k} \right) = - \vec{\nabla} V$$

potencial elétrico de uma esfera



$$E = \frac{1}{4\pi\epsilon_0} \frac{Q_T}{r^2}$$

$$V_B - V_A = - \int_A^B \vec{E} \cdot d\vec{r}$$

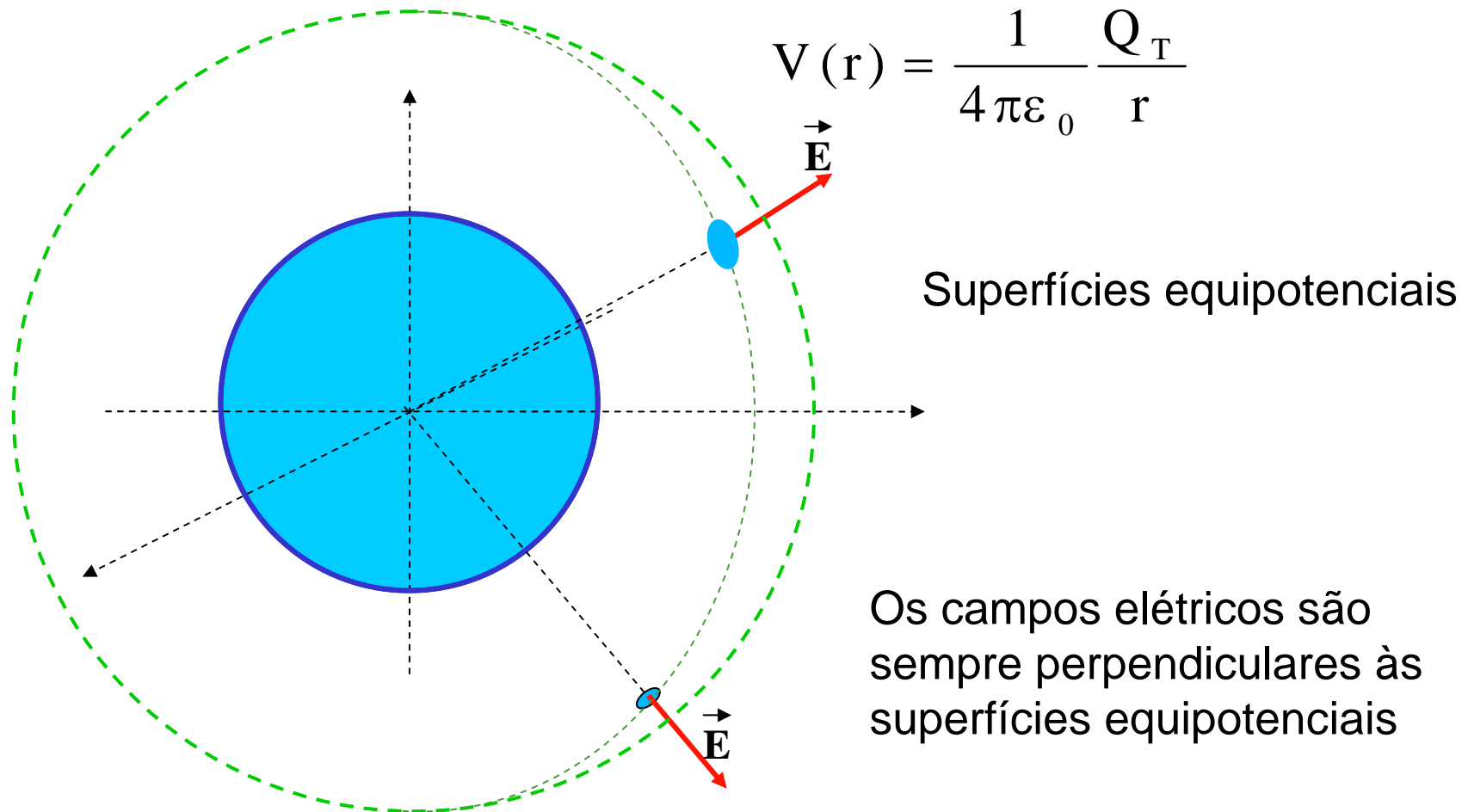
$$V_B - V_A = - \int_A^B E dr = - \int_A^B \frac{1}{4\pi\epsilon_0} \frac{Q_T}{r^2} dr = - \frac{1}{4\pi\epsilon_0} Q_T \left( -\frac{1}{r} \right)_A^B = \frac{1}{4\pi\epsilon_0} Q_T \left( \frac{1}{B} - \frac{1}{A} \right)$$

Se usarmos a referência no infinito

$$A \rightarrow \infty \Rightarrow V_A \rightarrow 0$$

$$\lim_{A \rightarrow \infty} \frac{1}{A} \rightarrow 0$$

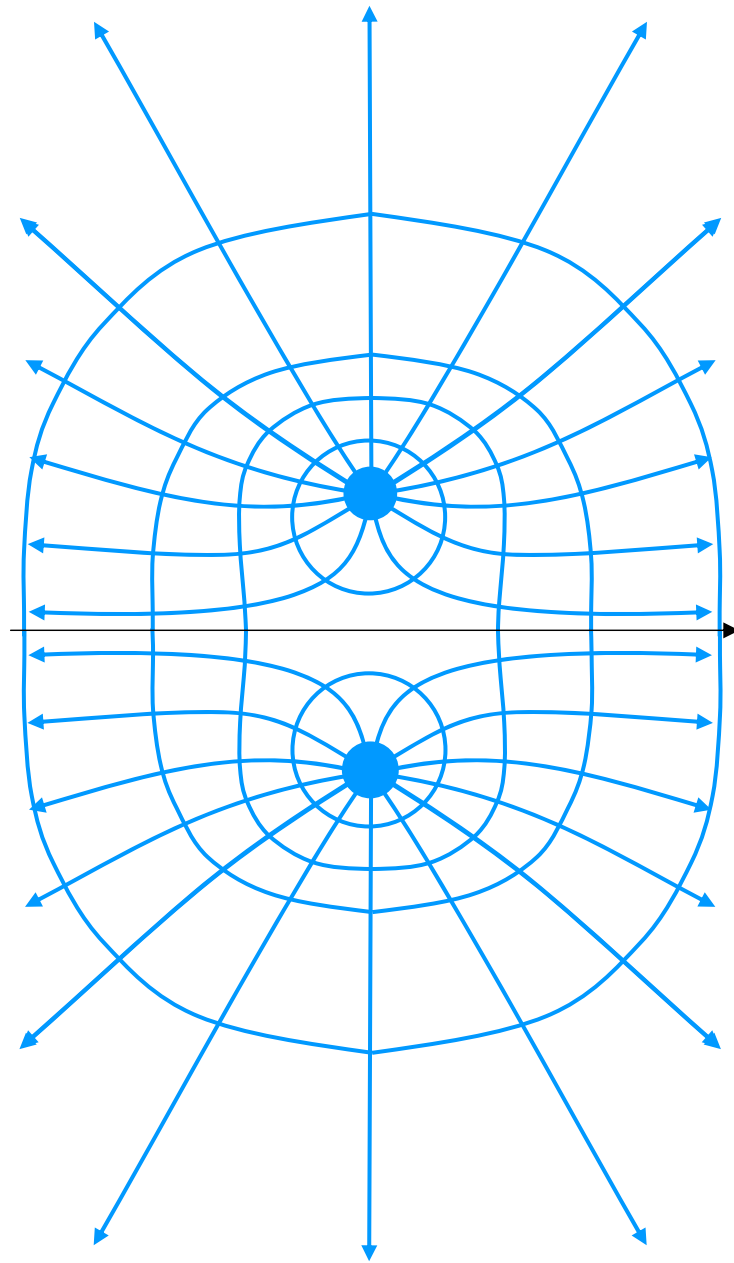
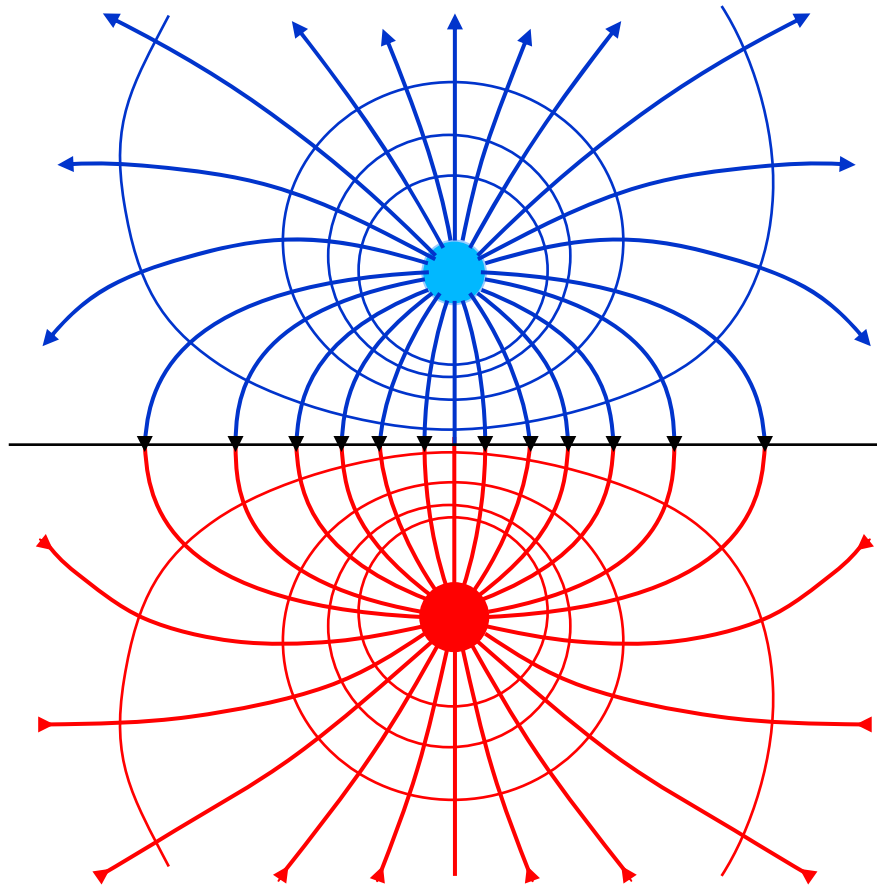
$$V(r) = \frac{1}{4\pi\epsilon_0} \frac{Q_T}{r}$$

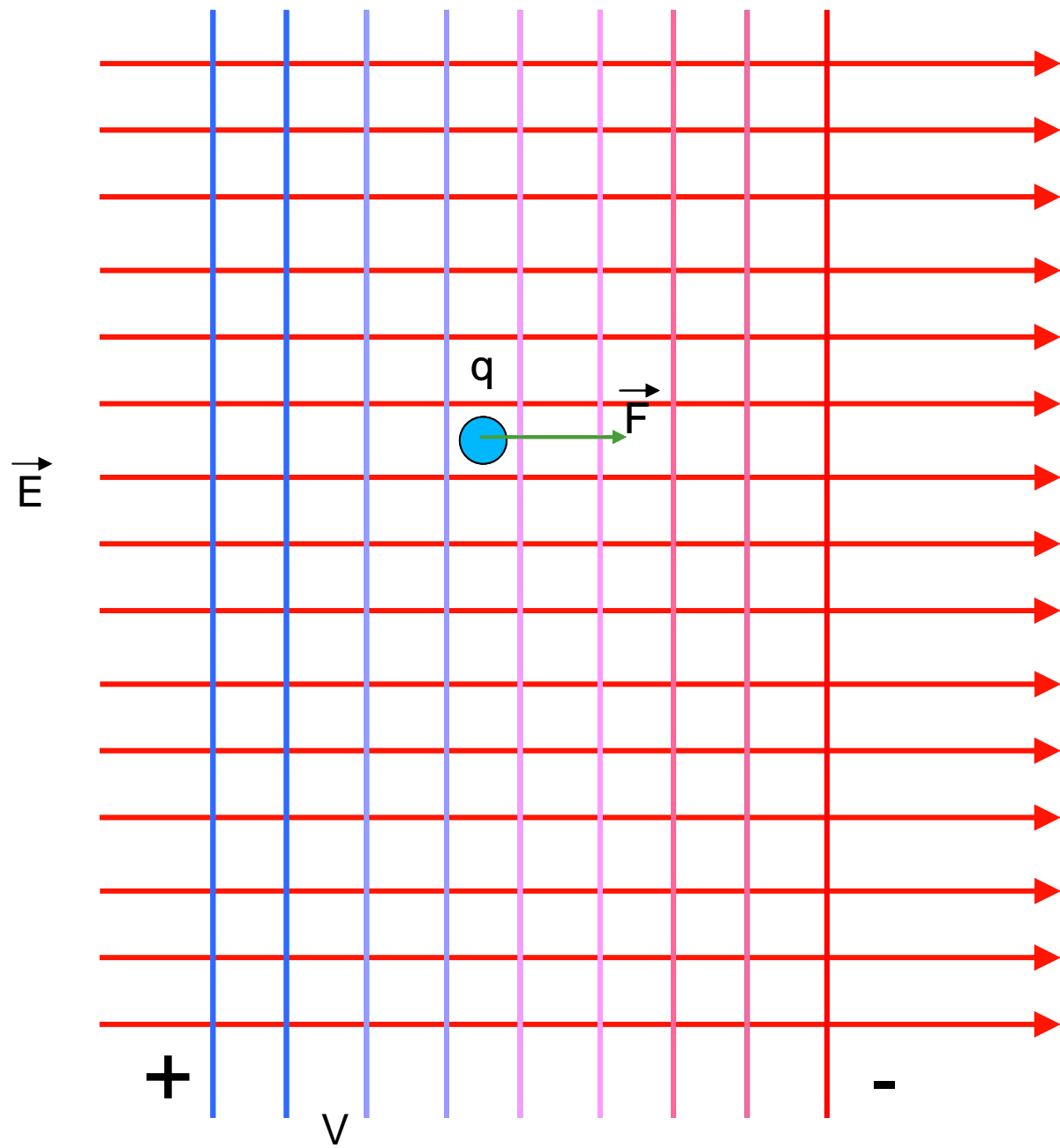


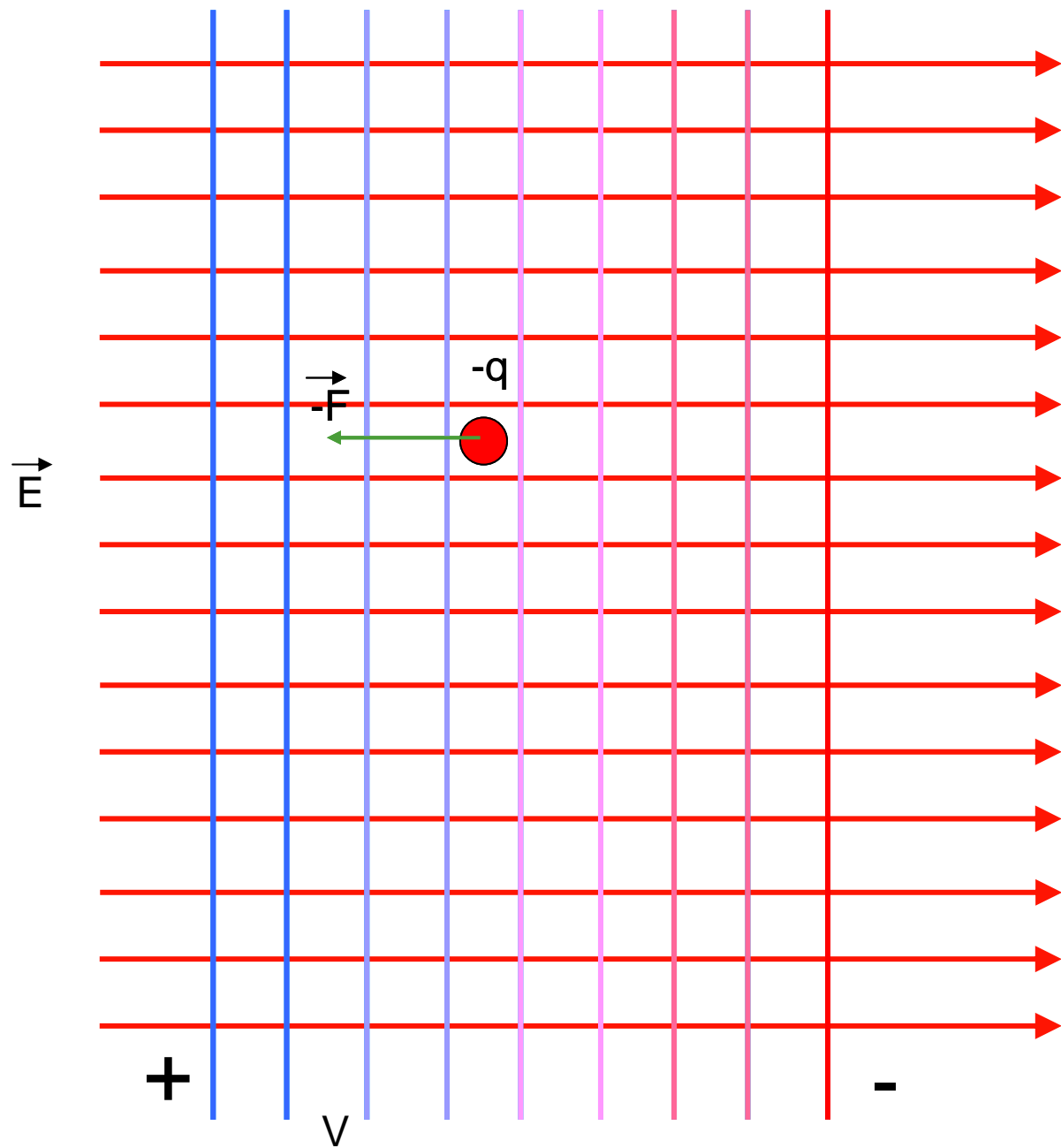
$$V_B - V_A = - \int_A^B \vec{E} \cdot d\vec{r}$$

Se o campo elétrico é perpendicular à  $d\vec{r}$   
então  $V_A = V_B$

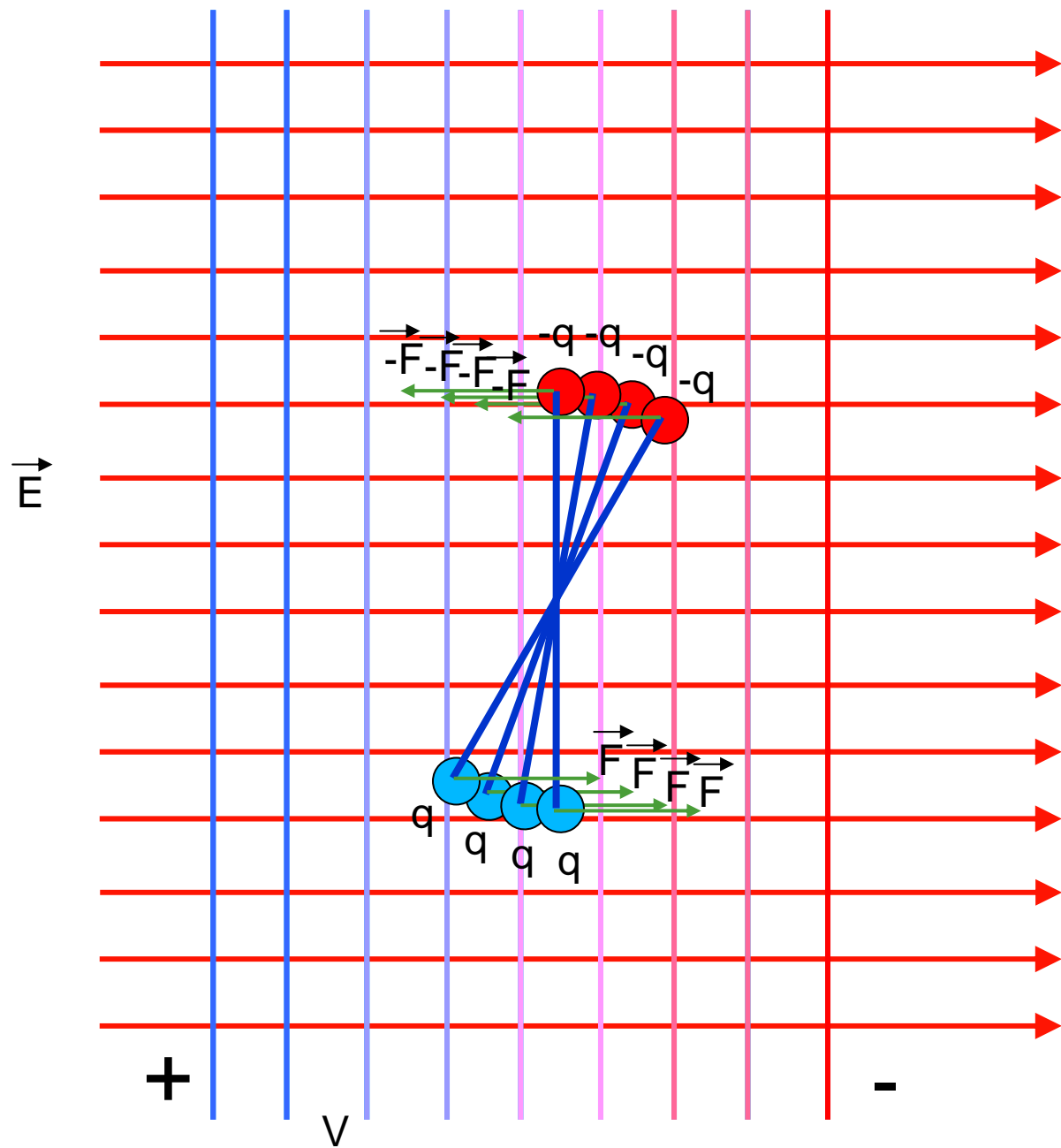
$$\Delta V = -\int \vec{E} \cdot d\vec{r}$$

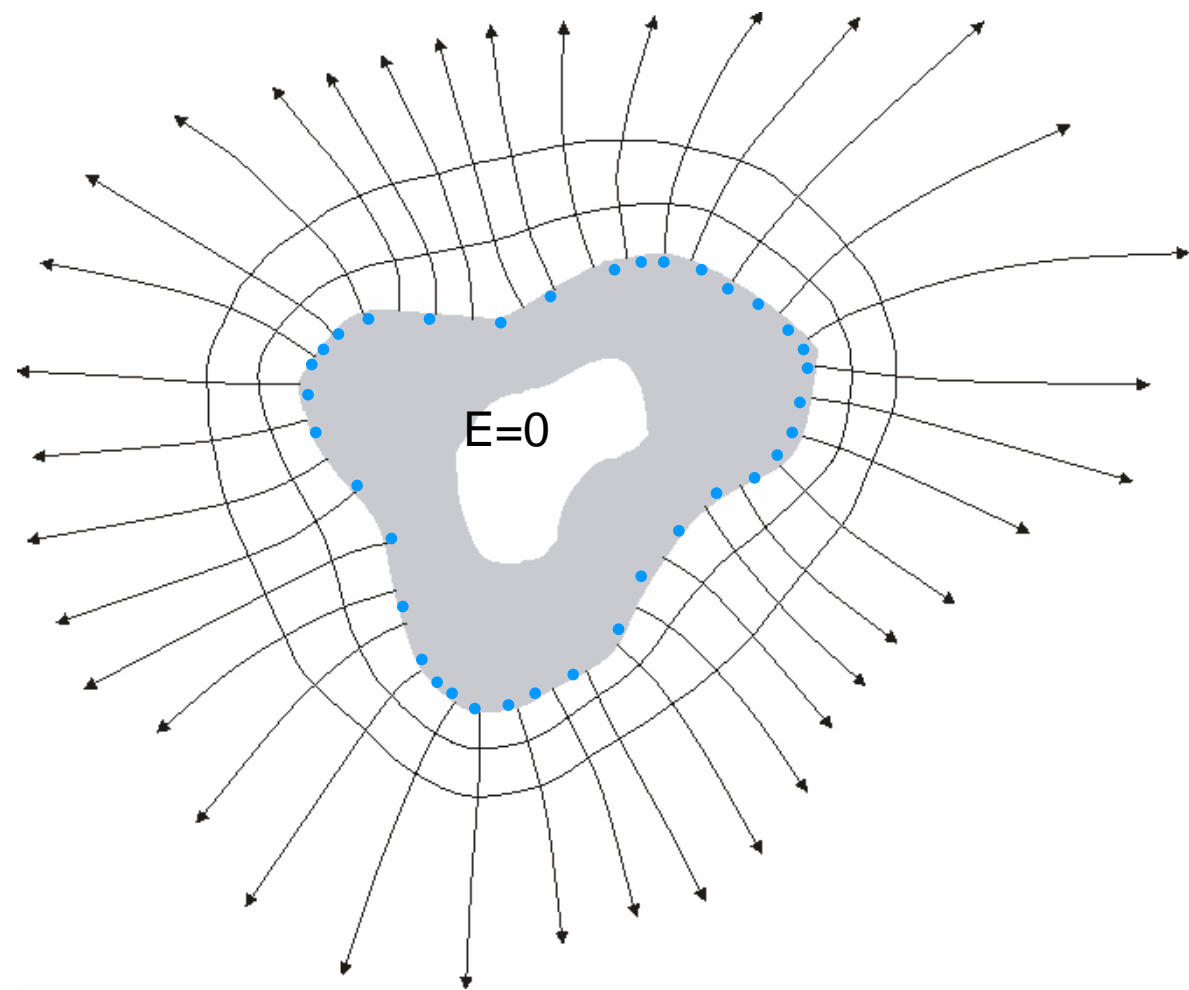


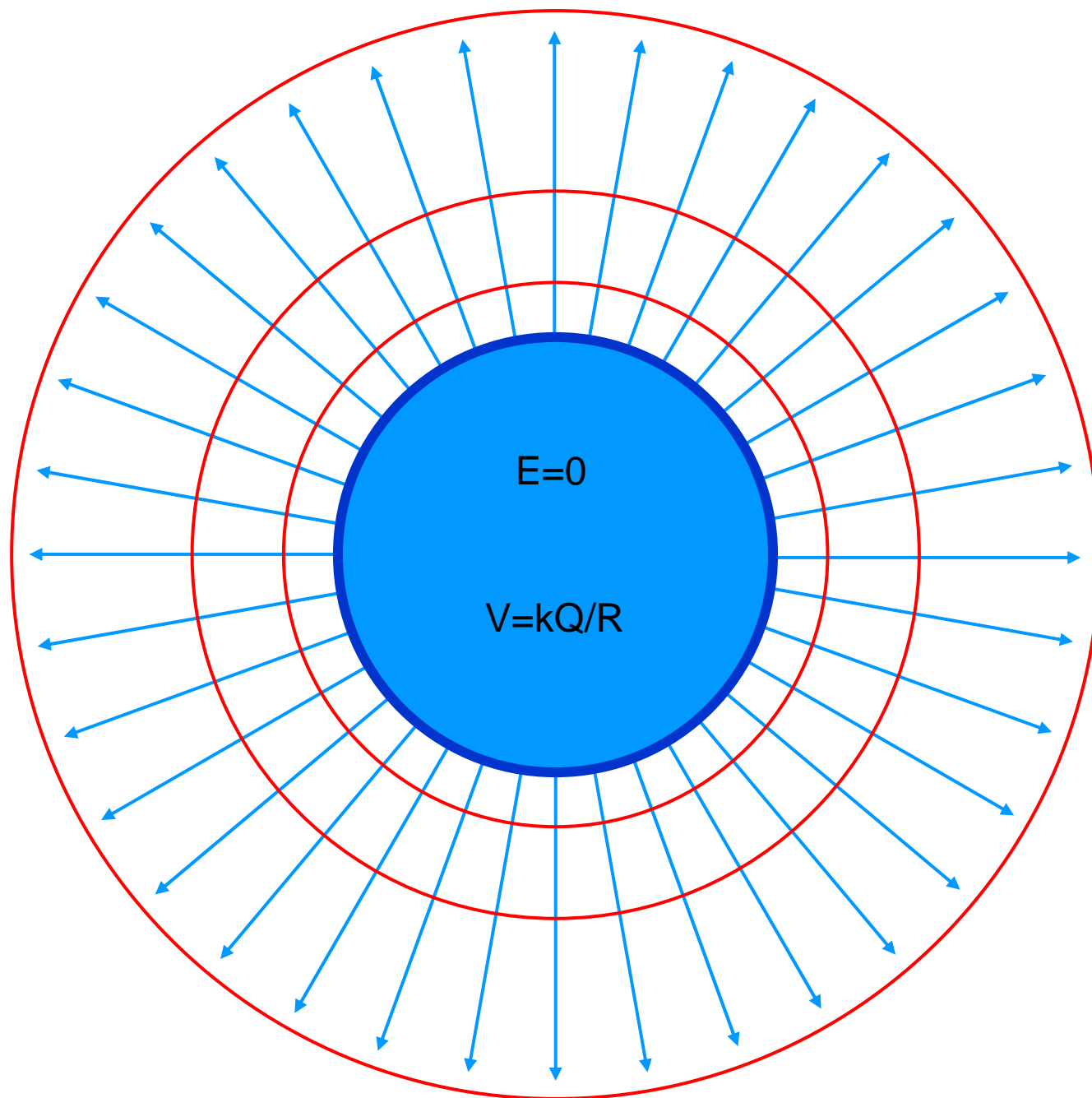


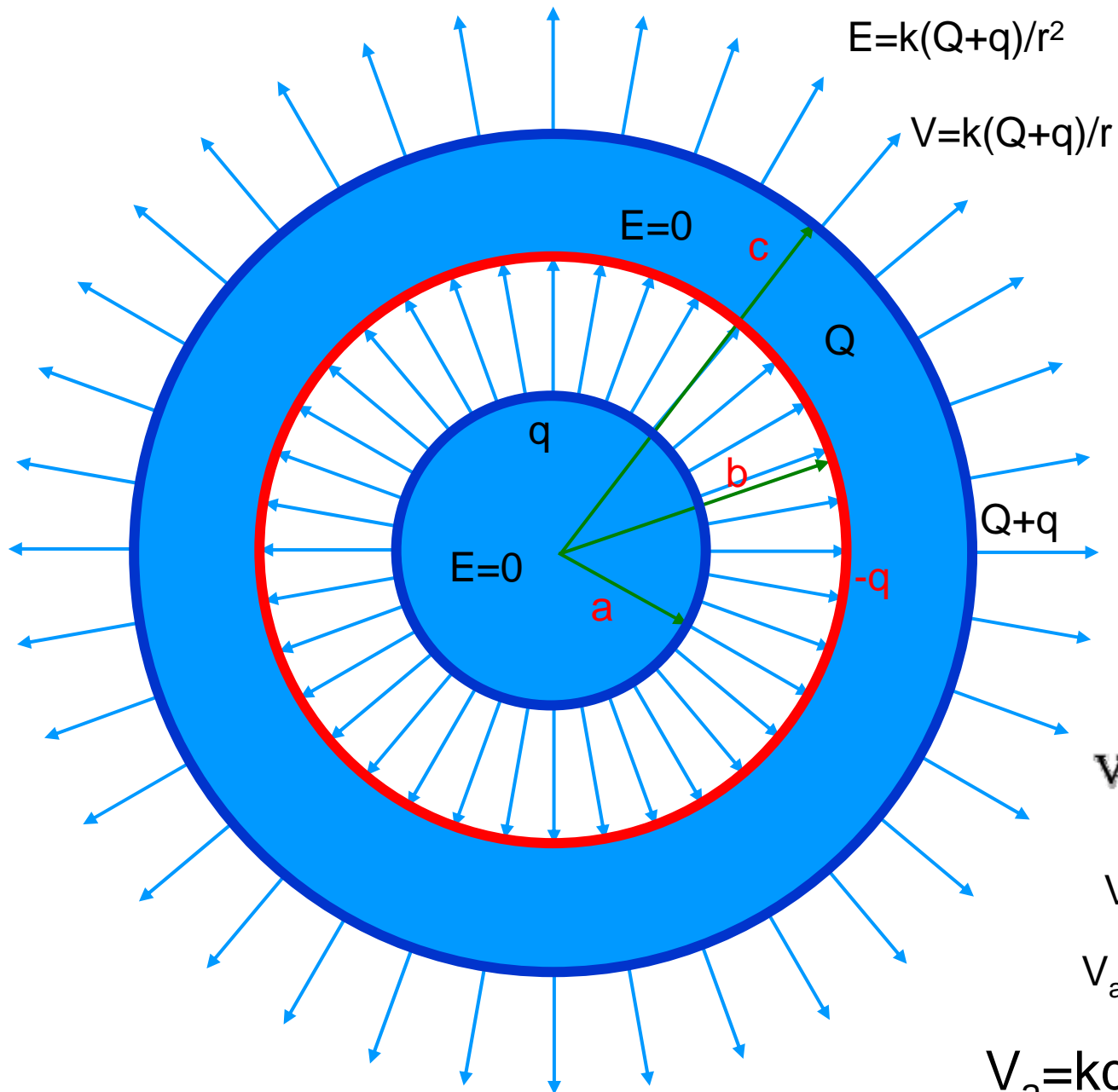












$$E = k(Q+q)/r^2$$

Para  $r=c$

$$E = k(Q+q)/c^2$$

$$V_c = k(Q+q)/c$$

Para  $r=b$

$$V_b = k(Q+q)/c$$

Para  $r=a$

Para  $a < r < b$

$$E = kq/r^2$$

$$V_B - V_A = - \int_A^B \vec{E} \cdot d\vec{r}$$

$$V_a - V_b = kq(1/a - 1/b)$$

$$V_a = kq(1/a - 1/b) + V_b$$

$$V_a = kq(1/a - 1/b + 1/c)$$