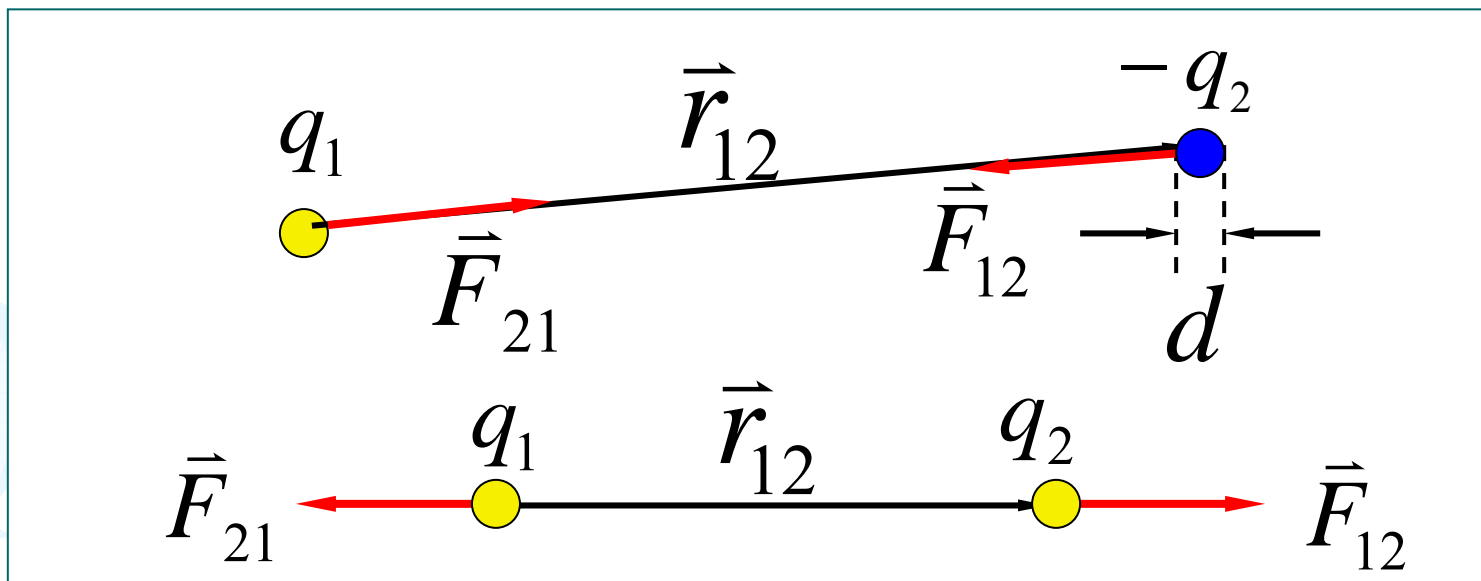


一 点电荷模型 ($d \ll r_{12}$)

二 库仑定律

$$\vec{F}_{12} = k \frac{q_1 q_2}{r_{12}^2} \vec{e}_{12} = -\vec{F}_{21}$$

SI制 $k = 8.98755 \times 10^9 \text{ N} \cdot \text{m}^2 \cdot \text{C}^{-2}$

库仑定律 $\vec{F}_{12} = k \frac{q_1 q_2}{r_{12}^2} \vec{e}_{12} = -\vec{F}_{21}$

◆ 库仑力遵守牛顿第三定律

◆ 令 $k = \frac{1}{4\pi \varepsilon_0}$ (ε_0 为真空电容率)

$$\begin{aligned} \varepsilon_0 &= \frac{1}{4\pi k} = 8.8542 \times 10^{-12} \text{ C}^2 \cdot \text{N}^{-1} \cdot \text{m}^{-2} \\ &= 8.8542 \times 10^{-12} \text{ F} \cdot \text{m}^{-1} \end{aligned}$$

$$\vec{F}_{12} = \frac{1}{4\pi \varepsilon_0} \frac{q_1 q_2}{r_{12}^2} \vec{e}_{12}$$



例 在氢原子内, 电子和质子的间距为 $5.3 \times 10^{-11} \text{ m}$. 求它们之间电相互作用和万有引力, 并比较它们的大小.

解 $m_e = 9.1 \times 10^{-31} \text{ kg}$ $e = 1.6 \times 10^{-19} \text{ C}$

$$m_p = 1.67 \times 10^{-27} \text{ kg} \quad G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2 \cdot \text{kg}^{-2}$$

$$F_e = \frac{1}{4\pi \epsilon_0} \frac{e^2}{r^2} = 8.1 \times 10^{-6} \text{ N}$$

$$F_g = G \frac{m_e m_p}{r^2} = 3.7 \times 10^{-47} \text{ N}$$

$$\left. \begin{array}{l} F_e = 8.1 \times 10^{-6} \text{ N} \\ F_g = 3.7 \times 10^{-47} \text{ N} \end{array} \right\} \frac{F_e}{F_g} = 2.27 \times 10^{39}$$

(微观领域中, 万有引力比库仑力小得多, 可忽略不计.)