5-9 静电场中的电偶极子

一 外电场对电偶极子的力矩和取向作用

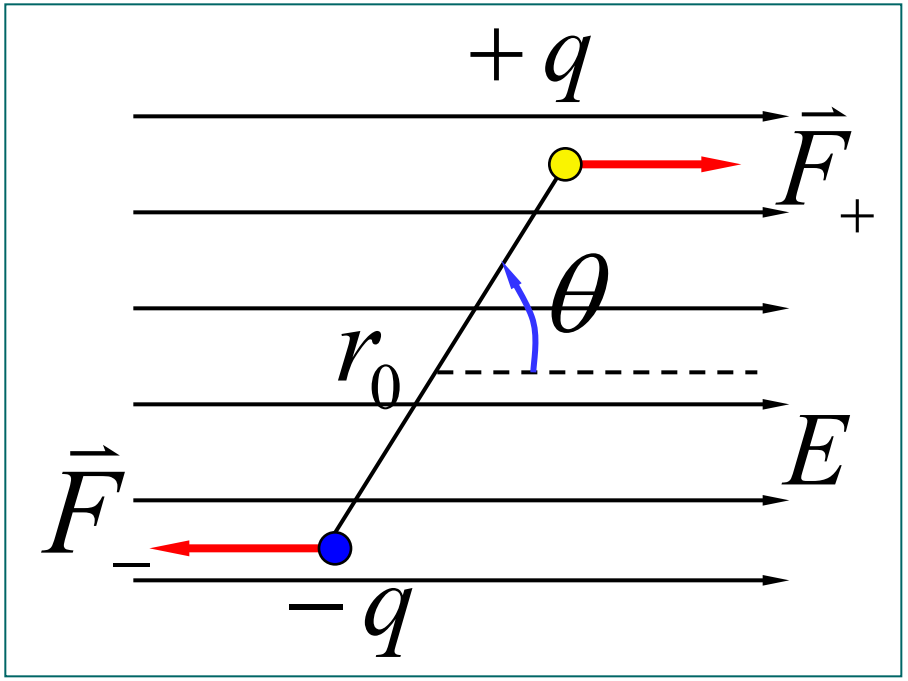
- 匀强电场中

$$\vec{F} = \vec{F}_+ + \vec{F}_-$$

$$= q\vec{E} - q\vec{E} = 0$$

$$M = qr_0 E\sin\theta$$

$$= pE\sin\theta$$



$$\vec{M} = \vec{p}\times\vec{E} \quad \begin{cases} \theta = 0 \\ \theta = \pi \end{cases} \quad \vec{M} = 0$$

稳定平衡

非稳定平衡

- 非匀强电场中 $\vec{F} = \vec{F}_+ + \vec{F}_- = q\vec{E}_+ - q\vec{E}_- \neq 0$

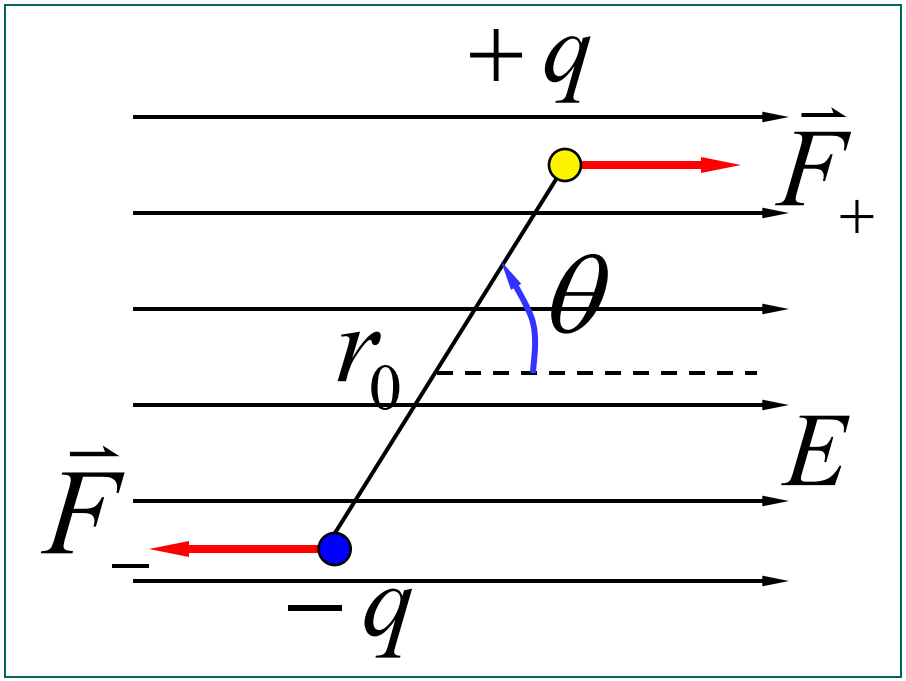
二 电偶极子在电场中的电势能和平衡位置

$$E_p = qV_+ - qV_-$$

$$= -q(-\frac{V_+ - V_-}{r_0 \cos\theta})r_0 \cos\theta$$

$$= -qr_0 E\cos\theta$$

$$E_p = -\vec{p}\cdot\vec{E}$$



$\theta = 0$ $\quad E_p = -p\cdot E$ 能量最低

$\theta = \pi/2$ $\quad E_p = 0$

$\theta = \pi$ $\quad E_p = p\cdot E$ 能量最高