

一、静电场

$$\text{库仑定律: } F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2}$$

$$\text{电场强度: } \vec{E} = \frac{\vec{F}}{q} \quad (\text{定义式})$$

①点电荷叠加 ②高斯定理 ③ $E = -\frac{\partial V}{\partial r}$

$$\text{真空中的高斯定理: } \oint_S \vec{E} \cdot d\vec{s} = \frac{\sum q}{\epsilon_0}$$

$$\oint \vec{E} \cdot d\vec{r} = 0 \quad \text{静电场为有源保守场}$$

$$\text{介质中的高斯定理: } \oint_D \vec{D} \cdot d\vec{s} = \sum q_v \quad (\text{自由电荷})$$

$$\vec{D} = \epsilon \vec{E}$$

$$\text{电势: } U_A = \int_A^{+\infty} \vec{E} \cdot d\vec{r}$$

$$U_{AB} = \int_A^B \vec{E} \cdot d\vec{r}$$

$$Ex = -\frac{\partial U}{\partial x}$$

$$\text{电容: } C = \frac{Q}{U}$$

$$\text{平行板电容: } C = \frac{\epsilon_0 S}{d}$$

静电场中的导体: 静电平衡, 等势体, 内无电场

$$\text{静电场能量密度: } w_e = \frac{1}{2} \epsilon E^2$$

二、恒定磁场

$$\text{恒定电流: } \oint_S \vec{J} \cdot d\vec{s} = 0$$

$$\text{欧姆定律的微分形式: } \vec{J} = \sigma \vec{E}$$

$$\text{电动势: } \epsilon_0 = \int E_k \cdot d\vec{r}$$

$$\text{毕-萨定理: } d\vec{B} = \frac{\mu_0}{4\pi} \frac{I d\vec{r} \times \vec{r}}{r^3}$$

$$\begin{array}{c} \uparrow I \\ \text{无限长} \end{array} \quad B = \frac{\mu_0 I}{2\pi r}$$

$$\begin{array}{c} \uparrow \\ \text{半无限长} \end{array} \quad B = \frac{\mu_0 I}{4\pi r}$$

$$\text{圆环} \quad B_0 = \frac{\mu_0 I}{2R}$$

$$\oint_S \vec{B} \cdot d\vec{s} = 0$$

$$\text{真空中的安培环路: } \oint_L \vec{B} \cdot d\vec{l} = \mu_0 \sum I$$

恒定磁场 无源有旋 非保守场

$$\text{洛伦兹力: } \vec{F} = q \vec{v} \times \vec{B}$$

$$\text{磁场对载流线圈的磁力矩: } \vec{M} = \vec{m} \times \vec{B}$$

$$\text{磁矩 } \vec{m} = I \vec{s}$$



$$\text{磁介质: } \begin{cases} \text{顺磁质: } \mu_r > 1 \\ \text{抗磁质: } \mu_r < 1 \\ \text{铁磁质: } \mu_r \gg 1 \end{cases}$$

$$介质中的安培环路定理: \oint \vec{H} \cdot d\vec{l} = \sum I_i \text{ (传导电流)}$$

$$\vec{B} = \mu_0 \vec{H} = \mu_r \vec{H}$$

三、变化的磁场

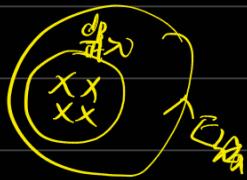
$$\text{电磁感应: } \epsilon_n = -N \frac{d\Phi_B}{dt}$$

$$\text{动生电动势: } \epsilon_{AB} = \int_A^B (\vec{V} \times \vec{B}) dt$$

$$\left\{ \begin{array}{l} \text{自感: } L = \frac{\Phi_B}{I_1} \\ \text{互感: } M = \frac{\Phi_{12}}{I_1} = \frac{\Phi_{21}}{I_2} \end{array} \right.$$

$$\text{磁场能量密度: } w_m = \frac{1}{2} \mu H^2$$

$$\text{麦克斯韦方程组: } \left\{ \begin{array}{l} \oint \vec{E}_{\text{场}} \cdot d\vec{l} = - \oint \frac{\partial \vec{B}}{\partial t} \cdot d\vec{s} \\ \oint \vec{H} \cdot d\vec{l} = \oint (\vec{j} + \frac{\partial \vec{D}}{\partial t}) \cdot d\vec{s} \end{array} \right. \quad (\text{左旋})$$



$$\text{电磁波: } U = \frac{1}{4\pi\epsilon_0}$$

$$\sqrt{\epsilon} E = \sqrt{\mu} H \quad (W = \epsilon E^2 = \mu H^2)$$

$$\text{能流密度: } S = \vec{E} \times \vec{H}$$

四、量子物理

$$\text{黑体辐射: } M = \sigma T^4$$

$$\text{光电效应: } hV = \frac{1}{2} m V_h^2 + W$$

$$\lambda_m T = b$$

$$\text{截止频率: } V_0 = \frac{W}{h}$$

$$P = \frac{h}{\lambda}$$

$$\text{遏止电压: } eU = hV - W$$

$$\Delta x \Delta p_x \geq \frac{\hbar}{2}$$

$$\text{氢原子: } E_l = -13.6 \text{ eV}$$

$$E_n \propto \frac{1}{n^2}, \quad V \propto \frac{1}{n}, \quad r \propto n^2$$

量子态 (n, l, m_l, m_s)

$$l = 0, 1, \dots, n-1$$

$$L = \sqrt{\mu(\hbar)} \frac{\hbar}{\lambda}$$

$$m_l = 0, \pm 1, \pm 2, \dots, \pm l$$

$$L_z = m_l \hbar$$

$$m_s = \pm \frac{1}{2}$$

$$S_z = m_s \hbar$$