比奥萨法尔定律

$dB=\frac{\mu_0 Id\overrightarrow{l}\times\overrightarrow{r}}{4\pi r^3}$

有限长直导线

$B=\frac{\mu_0 I}{4\pi r_0}(\cos\theta_1-\cos\theta_2)$

张角α 的圆弧电流中心

$B=\frac{\mu_0 I}{4\pi R}\alpha=\frac{\mu_0 I}{2R}\frac{\alpha}{2\pi}$

圆环

$B=\frac{\mu_0 IR^2}{2(R^2+r_0^2)^{\frac{3}{2}}}$

$A=I(\Phi_f-\Phi_i)$

$\Phi=\frac{\mu_0 Il}{2\pi}\ln\frac{d_2}{d_1}$

$\overrightarrow{M}=\overrightarrow{m}\times\overrightarrow{B}$

$\overrightarrow{m}=IS\overrightarrow{e_n}$

$\oint_l\overrightarrow{E}\cdot d\overrightarrow{l}=-\iint\frac{\partial\overrightarrow{B}}{\partial t}\cdot d\overrightarrow{S}$

$U_{MA}=\epsilon_{AM}-Ir$

能量密度

点电荷:

$W_e=\frac{1}{2}\int Vdq$

电容器:

$w_e=\frac{1}{2}\epsilon_0 E^2$

$W_e=\iiint_\Omega w_e d\tau$

电感

$\Psi=LI$

静电场	**稳恒电场**
电荷周边，对电荷有作用力	稳恒电场，电流，磁针有作用力
$F=\frac{1}{4\pi\epsilon_0}\frac{qq_0}{r^2}$	$dF_{12}=\frac{\mu_0}{4\pi}\frac{I_1 I_2 dl_2\times(dl_1\times e_{12})}{r_1 2^2}$
$E=\frac{F}{q}$	$B=\frac{F}{IL}$
$E=\int\frac{\lambda dl}{4\pi\epsilon_0 r^2}$	$dB=\frac{\mu_0}{4\pi}\frac{Id\overrightarrow{l}\times\overrightarrow{e_r}}{r^2}$

	电场
点电荷	$E=\frac{1}{4\pi\epsilon}\frac{q}{r^2}e_r$
偶极子	$E=\frac{ql}{4\pi\epsilon_0\left(r^2+\frac{l^2}{4}\right)^{\frac{3}{2}}}$ $E_{mid}=\frac{ql}{4\pi\epsilon_0 r^2}=-\frac{p}{4\pi\epsilon_0 r^3}$ $E_{ext}=\frac{2ql}{4\pi\epsilon_0 r^2}=-\frac{2p}{4\pi\epsilon_0 r^3}$
导线	$E=\frac{\lambda}{2\pi\epsilon_0 d}$ $E_x=\frac{\lambda}{4\pi\epsilon_0 d}(\sin\theta_2-\sin\theta_1)$ $E_y=\frac{\lambda}{4\pi\epsilon_0 d}(\cos\theta_2-\cos\theta_1)$ $E=\frac{\sigma}{2\epsilon_0}n$

	磁场
导线	$B=\frac{\mu_0 I}{4\pi a}(\cos\theta_1-\cos\theta_2)$ $B_{mid}=\frac{\mu_0 I}{2\pi a}\cos\theta$ $B_\infty=\frac{\mu_0 I}{2\pi a}$ $B_{\frac{\infty}{2}}=\frac{B_\infty}{2}$ $B_{ext}=0$
圆环	$B=\frac{\mu_0 I R^2}{2(R^2+z^2)^{\frac{3}{2}}}$ $B\approx\frac{\mu_0 I}{2R}e_n$
螺线管	$B=\frac{\mu_0 n I}{2}(\cos\beta_2-\cos\beta_1)$ $B_\infty=\mu_0 n I$ $B_{\frac{\infty}{2}}=\frac{B_\infty}{2}$

高斯定理	稳恒电场
$\Phi_E=\oiint E\cdot dS=\frac{1}{\epsilon_0}\sum q$ $\oint_L E\cdot dl=0$	$\Phi_B=\oiint B\cdot dS=0$ $\oint_L B\cdot dl=\mu_0\sum I$

静电场	感应电场
$\oiint E\cdot dS=\frac{q}{\epsilon_0}$ $\oint_L E\cdot dl=0$	$\oiint E_k\cdot dS=0$ $\oint_L E_k\cdot dl=-\iint_S\frac{\partial B}{\partial t}dS$

磁介质	电解质
$H = \frac{B}{\mu_0} - M$	$D = \epsilon_0 E + P$
$B = \mu_r \mu_0 H$	$D = \chi_r \epsilon_0 E$
$H_{1t} = H_{2t}$ $B_{1n} = B_{2n}$	$D_{1n} = D_{2n}$ $E_{1t} = E_{2t}$
$w_m = \frac{1}{2} BH = \frac{1}{2} LI^2$	$w_e = \frac{1}{2} DE = \frac{1}{2} QU$

$\oiint_S \mathbf{D} \cdot d\mathbf{S} = 0$
$\oiint_S \mathbf{B} \cdot d\mathbf{S} = 0$
$\oint_l \mathbf{E} \cdot d\mathbf{l} = -\iint_S \frac{\partial \mathbf{B}}{\partial t} \cdot d\mathbf{S}$
$\oint_l \mathbf{H} \cdot d\mathbf{l} = \iint_S \frac{\partial \mathbf{D}}{\partial t} \cdot d\mathbf{S}$

$\frac{\sin i_1}{\sin i_2} = \frac{n_2}{n_1}$

马吕斯定律:
$I_2 = I_1 \cos^2 \alpha = \frac{I_0}{2} \cos^2 \alpha$

$i_b = \arctan\left(\frac{n_2}{n_1}\right)$

- $n_e > n_o$ 正晶体
- $n_e < n_o$ 负晶体

二分之一波片:

- 线偏振-线偏振
- 圆偏振-圆偏振

四分之一波片

- 线偏振光 入射角$\alpha = \frac{\pi}{4}$ 圆偏振光
- 反之。

明 $x_m = m\frac{L}{d}\lambda$

暗 $x_m = (2m-1)\frac{\lambda}{2}\frac{L}{d}$

$\Delta x = \frac{L}{d}\lambda$

$\Delta d = \frac{\lambda}{2n}$
$\Delta l = \frac{\lambda}{2n\theta}$

$\delta = 2nd + \frac{\lambda}{2} = \begin{cases} m\lambda & \text{明} \\ (2m+1)\frac{\lambda}{2} & \text{暗} \end{cases}$

$r^2 = R^2 - (R-d)^2 \approx 2dR$

$\Delta\lambda = \frac{\lambda^2}{2\Delta D}$

夫琅禾费单缝衍射
$a \sin\theta = m\lambda$

夫琅禾费圆孔衍射
艾里斑半径
$R = 1.22\frac{\lambda}{D}f$

最小分辨角
$\theta_0 = \theta_1 \approx \sin\theta_1 = 1.22\frac{\lambda}{D}$

N缝 两明纹间有N-1条暗纹 N-2 个次极大

$R = \frac{\lambda}{\Delta\lambda} = mN - 1 \approx mN$

布拉格公式
$2d\sin\varphi = m\lambda$

斯土蕃定律
$M_B = \sigma T^4$

维恩位移定律
$T\lambda_m = b$

$eU_a = \frac{1}{2}mv_0^2$
$U_a = k(\nu - \nu_0)$
$h\nu = W_0 + \frac{1}{2}mv^2$

$L_n = n\hbar$
$E_n = \frac{E_1}{n^2}, E_1 = -13.6eV$

德布罗意波
$\lambda = \frac{h}{p}$

$\Delta x \Delta p_x \geq h$
$\Delta E \Delta t \geq h$

归一化

$P = |\Psi(r,t)|^2 dV$
$\rho = \frac{P}{dV}$
$\int_\Omega \Psi(r,t)\Psi^*(r,t)dV = 1$

$\hat{H}\Phi(r) = E\Phi(r)$
$\hat{H} = -\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2} + U(x,t)$

$L^2 = l(l+1)\hbar^2, l = 0, 1, 2, \cdots, n-1$
$L_z = m_l\hbar, m_l = -l, -l+1, \cdots, l-1, l$

自旋磁矩与自旋角动量
$\mu_s = -\frac{e}{m_e}\mathbf{S} = -\frac{e}{m_e}m_s\hbar, m_s = -\frac{1}{2}, \frac{1}{2}$