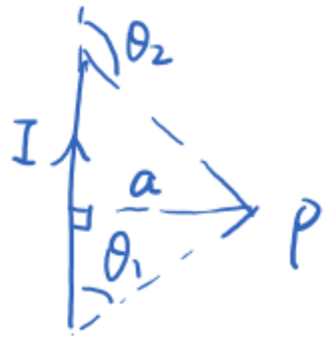
电磁学复习大表

2019 年 5 月 17 日 18:29 Log Creative

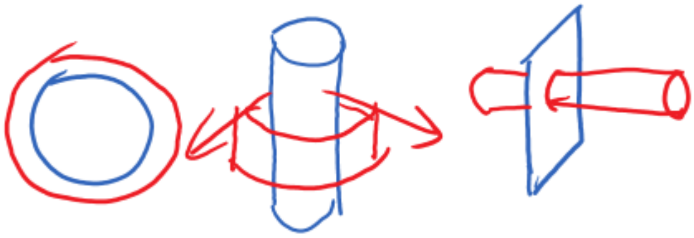
静电场	稳恒磁场
电荷周边，对电荷有作用力	稳恒电场，电流，磁针有作用力
$F=\frac{1}{4\pi\epsilon_0}\cdot\frac{qq_0}{r^2}\boldsymbol{e_r}$	$\mathrm{d}F_{12}=\frac{\mu_0}{4\pi}\cdot\frac{I_1I_2\mathrm{d}l_2\times(\mathrm{d}l_1\times e_{12})}{r_{12}^2}$
$E=\frac{F}{q_0}$	$B=\frac{F}{IL},\quad F=Il\times B=qv\times B$ $=m\times B$
$E_{ALL}=E_1+E_2=\sum_{i=1}^{N}E_i$ $=\int\frac{\rho dV}{4\pi\epsilon_0r^2}$ $=\int\frac{\sigma ds}{4\pi\epsilon_0r^2}$ $=\int\frac{\lambda dl}{4\pi\epsilon_0r^2}$	$\mathrm{d}B=\frac{\mu_0}{4\pi}\cdot\frac{I\mathrm{d}l\times e_r}{r^2}$

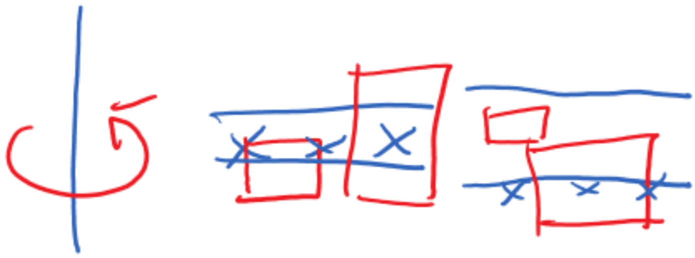
点电荷	$E=\frac{1}{4\pi\epsilon_0}\cdot\frac{q}{r^2}e_r$	导线	$B=\frac{\mu_0I}{4\pi a}(cos\theta_1-cos\,\theta_2)$ $B_{\mathrm{mid}}=\frac{\mu_0I}{2\pi a}cos\,\theta$ $B_\infty=\frac{\mu_0I}{2\pi a}$ $B_{\frac{\infty}{2}}=\frac{B_\infty}{2}$ $B_{\mathrm{ext}}=0$
偶极子	$E=\frac{ql}{4\pi\epsilon_0\left(r^2+\frac{l^2}{4}\right)^{\frac{3}{2}}}$	圆环	$B=\frac{\mu_0IR^2}{2(R^2+z^2)^{\frac{3}{2}}}$ $B\approx\frac{\mu_0I}{2R}e_n$
导线	$E_{\mathrm{mid}}=\frac{ql}{4\pi\epsilon_0r^2}=-\frac{p}{4\pi\epsilon_0r^3}$ $E_{\mathrm{ext}}=\frac{2ql}{4\pi\epsilon_0r^2}=-\frac{2p}{4\pi\epsilon_0r^3}$ $E=\frac{\lambda}{2\pi\epsilon_0d}$ $E_x=\frac{\lambda}{4\pi\epsilon_0d}(\sin\theta_2-\sin\theta_1)$	螺线管	$B=\frac{\mu_0nI}{2}(cos\,\beta_2-cos\,\beta_1)$ $B_\infty=\mu_0nI$ $B_{\frac{\infty}{2}}=\frac{B_\infty}{2}$



	$E_y = \frac{\lambda}{4\pi\epsilon_0 d}(\cos\theta_2 - \cos\theta_1)$ $E = \frac{\sigma}{2\epsilon_0} n$		

高斯定理	稳恒电场
电通量 $\phi_E = \oiint E \cdot dS = \frac{1}{\epsilon_0}\sum_i q_i$ $\oint_L E \cdot dl = 0$	磁通量 $\phi_B = \oiint B \cdot dS = 0$ $\oint_L B \cdot dl = \mu_0 \sum_i I_i$





磁介质	电介质
磁化强度 M，B' 磁场强度$H = \frac{B}{\mu_0} - M$ $\oint_L B \cdot dl = \mu_0 \sum I + \mu_0 \sum I'$	极化强度 P，E' 电位移矢量$D = \epsilon_0 E + P$ $\oiint E \cdot dl = \frac{1}{\epsilon_0}\sum q + \frac{1}{\epsilon_0}\sum q'$
$\oint_L H \cdot dl = \frac{1}{\mu_0}\oint_L B \cdot dl$ $-\oint_L M \cdot dl = \sum I_0$	$\oiint D \cdot ds = \epsilon_0 \oiint E \cdot dS$ $+ \oiint P \cdot dS$ $= \sum q_0$
$M = \chi_m H$ $B = (1+\chi_m)\mu_0 H = \mu_r \mu_0 H$	$P = \chi_e \epsilon_0 E$ $D = (1+\chi_e)\epsilon_0 E = \chi_r \epsilon$
$\chi_m > 0, \mu_r > 1$（顺） $\chi_m < 0, \mu_r < 1$（抗）	
$H_{1t} = H_{2t}$ $B_{1n} = B_{2n}$	$D_{1n} = D_{2n}$ $E_{1t} = E_{2t}$
$w_m = \frac{1}{2}\cdot\frac{B^2}{\mu} = \frac{1}{2}\mu H^2 = \frac{1}{2}BH$ $= \frac{1}{2}LI^2$	$w_e = \frac{1}{2}\cdot\frac{D^2}{\epsilon} = \frac{1}{2}\epsilon E^2 = \frac{1}{2}DE$ $= \frac{1}{2}QU$

静电场	感应电场
由静止电荷产生	由变化磁场产生
$\oint E \cdot dS = \frac{q}{\epsilon_0}$	$\oint E_{旋} \cdot dS = 0\left(\boldsymbol{\nabla} \cdot \boldsymbol{E}_{旋} \equiv 0\right)$
$\oint_L E \cdot dl = 0\,(\boldsymbol{\nabla} \times \boldsymbol{E} \equiv 0)$	$\oint_L E_{旋} \cdot dl = -\iint_S \frac{\partial B}{\partial t} dS$

$$\textit{Maxwell's Equations}$$

$$\begin{aligned}
&(1) & \boldsymbol{\nabla} \cdot \boldsymbol{E} &= \frac{\rho}{\epsilon_0} \\
&(2) & \boldsymbol{\nabla} \times \boldsymbol{E} &= -\frac{\partial \boldsymbol{B}}{\partial t} \\
&(3) & \boldsymbol{\nabla} \cdot \boldsymbol{B} &= 0 \\
&(4) & c^2\, \boldsymbol{\nabla} \times \boldsymbol{B} &= \frac{\partial \boldsymbol{E}}{\partial t} + \frac{\boldsymbol{j}}{\epsilon_0}
\end{aligned}$$