Everyday memory

No.
Date

① L的写法

$L = T - V = \frac{p_x^2}{2m} - V(x)$

$= \frac{1}{2}mv^2 - (e\phi + \frac{e}{c}\vec{v}\cdot\vec{A})$

$= -mc^2\sqrt{1-\beta^2} + \frac{e}{c}\vec{u}\cdot\vec{A}$

② H写法 $H = p\dot{q} - L = \frac{1}{2m}(p_r^2 + \frac{p_\theta^2}{r^2} + \frac{p_\varphi^2}{r^2\sin^2\theta}) + V(r,\theta,\varphi)$

③ 正则变换关系：
$$\begin{cases} dF = pdq - PdQ + (H'-H)dt \\ F = F(q, Q, t) \end{cases}$$

④ H关系 $\frac{\partial H}{\partial q} = -\dot{p}_i \quad \frac{\partial H}{\partial p} = +\dot{q}_i$

⑤ 渐近不变量 $I = \oint p dq = \int dp\, dq$

⑥ 完整的Maxwell方程：
$$\begin{cases} \nabla\times\vec{E} = -\frac{\partial\vec{B}}{\partial t} \\ \nabla\cdot\vec{E} = \rho/\varepsilon_0 \\ \nabla\cdot\vec{B} = 0 \\ \frac{1}{\mu_0}\nabla\times\vec{B} = \vec{J}_f + \vec{J}_m + \vec{J}_p + \varepsilon_0\frac{\partial\vec{E}}{\partial t} = \vec{J} + \varepsilon_0\frac{\partial\vec{E}}{\partial t} \end{cases}$$

⑦ 边界条件
$$\begin{cases} \vec{e}_n\times(\vec{E}_2-\vec{E}_1)=0 \\ \vec{e}_n\cdot(\vec{D}_2-\vec{D}_1)=\sigma_f \end{cases} \Leftrightarrow \begin{cases} E_{2t} = E_{1t} \\ \varepsilon_2 E_{2\perp} - \varepsilon_1 E_{1\perp} = \sigma_f \end{cases}$$

$$\begin{cases} \vec{e}_n\times(\vec{H}_2-\vec{H}_1) = \alpha_f \\ \vec{e}_n\cdot(\vec{B}_2-\vec{B}_1) = 0 \end{cases}$$

⑧ 规范性和B的表达式

$\partial_a A^a = 0 \Leftrightarrow \frac{1}{c}\partial_t\phi + \nabla\cdot\vec{A} = 0$

$$\begin{cases} \nabla\times\vec{A} = \vec{B} \\ \vec{E} = -\vec{A}_t - \nabla\varphi \end{cases}$$

$$\begin{cases} \vec{A} = \frac{\mu_0}{4\pi}\int\frac{\vec{J}(r')dV'}{|\vec{r}-\vec{r}'|} \\ \vec{B} = \frac{\mu_0}{4\pi}\int\frac{\vec{J}(x_1)\times(\vec{x}-\vec{x}_1)}{r^3}dV_1 \end{cases}$$

No.
Date

⑨. 磁矩表达式

$$\begin{cases} \vec{m} = \vec{\mu} = \frac{I}{2}\oint \vec{x}' \times d\vec{l}' \\ \vec{A} = \frac{\mu_0}{4\pi R^3} \cdot \vec{m} \times \vec{R} \end{cases}$$ (小心用)

⑩. 各种外场能量 力 力矩 角动量.

$$U = -\vec{m}\cdot\vec{B} = -\vec{p}\cdot\vec{E} = \frac{1}{2}\int \rho U\, dV = \frac{1}{2}\int \vec{J}\cdot\vec{A}\, dV$$

☆ $$\vec{L} = -\frac{\partial U}{\partial \theta} = \vec{m}\times\vec{B} = \vec{p}\times\vec{E}$$

$$\mathcal{E} = \oint \vec{E}\cdot d\vec{l} = -\frac{d}{dt}\int \vec{B}\cdot d\vec{s}.$$

$$dW = Y dy = \vec{\tau}\cdot d\vec{\theta} = \vec{F}\cdot d\vec{x}$$

⑪. Poission 方程: ~~$\Delta\varphi$~~ ~~$\Box A$~~

$$\begin{cases} \Delta\varphi - \frac{1}{c^2}\varphi_{tt} = -\rho \\ -\Box\vec{A} = \vec{J}_\mu/c \end{cases}$$

⑫. 偶极辐射.

$$\begin{cases} \vec{A}_{(1)} = \frac{\mu_0}{4\pi R} e^{ikR}\, \dot{\vec{p}} \\ \vec{B}_{(1)} = ik\vec{e}_R \times \vec{A}_{(1)} = \frac{1}{4\pi\varepsilon_0 c^3 R} e^{ikR}\, \ddot{\vec{p}} \times \vec{e}_R \\ \vec{E}_{(1)} = c\vec{B}\times\vec{e}_R = \frac{e^{ikR}}{4\pi\varepsilon_0 c^2 R}(\ddot{\vec{p}}\times\vec{e}_R)\times\vec{e}_R \\ \vec{S} = \frac{1}{2}\mathrm{Re}(\vec{E}^*\times\vec{H}) = \frac{|\ddot{p}|^2}{32\pi^2\varepsilon_0 c^3 R^2}\sin^2\theta\, \vec{e}_R. \\ P = \oint |\vec{S}| R^2 d\Omega = \frac{1}{4\pi\varepsilon_0}\cdot\frac{|\ddot{p}|^2}{3c^3} \end{cases}$$ Important !!

⑬. Relativity.

$$L = \begin{pmatrix} \gamma & -i\beta\gamma & & \\ -i\beta\gamma & \gamma & & \\ & & 1 & \\ & & & 1 \end{pmatrix}.$$

$$d\tau = \frac{1}{c}ds.$$

$$u_\mu = \frac{dx_\mu}{d\tau} = \gamma(\dot{x}_\mu).$$

$$g = \begin{pmatrix} -1 & & & \\ & 1 & & \\ & & 1 & \\ & & & 1 \end{pmatrix}.$$

$$V^\mu = (c, \vec{V_p}) \cdot \quad p^\mu = mu^\mu$$

$$V_\mu = (-c, \vec{V_p}).$$

$$\partial^\mu = \left(-\frac{1}{c}\frac{\partial}{\partial t}, \nabla\right) = \left(\frac{\partial}{\partial x_\mu}\right).$$

$$\cancel{F^{\alpha\beta} = \partial^\alpha A^\beta - \partial^\beta A^\alpha}$$

No.

Date

⑭ 电磁张量写法： $F^{\alpha\beta} = \partial^\alpha A^\beta - \partial^\beta A^\alpha$.

$$F^{0i} = E^i \qquad F^{ij} = \varepsilon^{ijk} B_k.$$

$$\Theta^{\mu\nu}_{em} = F^{\mu\lambda} F^{\nu}{}_{\lambda} + g^{\mu\nu}\left(-\tfrac{1}{4} F^{\alpha\beta} F_{\alpha\beta}\right).$$

$$\begin{cases} \partial_\mu J^\mu = 0. \\ -\Box A^\mu = J^\mu / c. \\ \partial_\mu A^\mu = 0. \\ \dfrac{dp^\mu}{d\tau} = e F^\mu{}_\nu \dfrac{U^\nu}{c}. \\ \partial_{[\rho} F_{\mu\nu]} = 0. \\ -\partial_\mu \Theta^{\mu\nu}_{em} = F^\mu{}_\nu \dfrac{J^\nu}{c}. \end{cases}$$

⑮ 变换坐标后：

$$\begin{cases} \bar{E}_{\parallel} = E_{\parallel} \qquad \bar{B}_{\parallel} = B_{\parallel}. \\ \vec{\bar{E}}_{\perp} = \gamma E_{\perp} + \gamma \vec{\beta} \times \vec{B}_{\perp} \qquad \vec{\bar{B}}_{\perp} = \gamma \vec{B}_{\perp} \mp \gamma \vec{\beta} \times \vec{E}_{\perp}. \end{cases}$$

No.
Date

磁矩的作用：外场中 $U = \vec{\mu}\cdot\vec{B}$. 则 $\vec{M} = \frac{\partial}{\partial\theta}U = \vec{\mu}\times\vec{B}$!!

环形电流的磁矩： $\vec{\mu} = I\oint \vec{x}\times d\vec{l}' = IR\cdot 2\pi R$.

问：极化方向如何确定？电磁张力张量？平板电流磁场？

radiation 部分考察最多！frame 也是：电磁场张量写法!!

矢量叉积. Green function.? 不同frame中的事情!!

二极矩的一系列关系. 规范（洛氏是 $\partial_a A^a = 0$. 即 $\nabla\cdot\vec{A} + \frac{1}{c}\frac{\partial\phi}{\partial t} = 0$.

则 $\vec{A} = \frac{1}{4\pi r} e^{-i\omega t + ikr}\int d^3r'\, J(r')/c$)

No.
Date

No.

Date

torque $\vec{N} = \vec{p} \times \vec{E} = \vec{\mu} \times \vec{B}$.

$U = -\vec{p} \cdot \vec{E} = \vec{\mu} \cdot \vec{B}$.

about vector:

$d\vec{r} = \sum \frac{\partial \vec{r}}{\partial p} dp = \sum \left| \frac{\partial \vec{r}}{\partial p} \right| dp \, \vec{e_p}$

$\Longrightarrow \sum_p \left| \frac{\partial \vec{r}}{\partial p} \right| \cdot \frac{\partial p}{\partial q} \vec{e_p} = \cancel{e_q} \left| \frac{\partial \vec{r}}{\partial q} \right| \vec{e_q}$.

记忆: $\vec{\nabla} \cdot \vec{v} = \sum \frac{\partial V_x}{\partial x} = \sum \frac{1}{B_q} \frac{\partial}{\partial q} (A V_q)$.

此处. $A = \frac{dx\,dy\,dz}{dr\,d\theta\,d\varphi}$. $A/B_q = \left| \frac{\partial q}{\partial \vec{r}} \right| \cancel{q = r, \theta, \varphi} \left| \frac{\partial \vec{r}}{\partial q} \right|^{-1}$

$\nabla T = \sum \frac{\partial T}{\partial q} \cdot \frac{\partial q}{\partial \vec{r}}$ $d\vec{r} = \frac{\partial \vec{r}}{\partial q} \cdot dq$.

No.
Date