N 812 [1]

$\varphi(r,t)$ - ?

$\vec{A}(r,t)$ - ?

$\vec{j} = c \, \mathrm{rot}[\vec{m}\,\delta(\vec{r}-\vec{v}t)] + \frac{\partial}{\partial t}[\vec{p}\,\delta(\vec{r}-\vec{v}t)]$

$\rho = -\mathrm{div}[\vec{p}\,\delta(\vec{r}-\vec{v}t)]$

$\mathrm{rot}\,\vec{B} = \frac{4\pi}{c}\vec{j} + \frac{1}{c}\frac{\partial E}{\partial t}$

$\mathrm{rot}\,\vec{E} = -\frac{1}{c}\frac{\partial \vec{B}}{\partial t}$

$\mathrm{div}\,\vec{E} = 4\pi\rho$

$\mathrm{div}\,\vec{B} = 0$

$\frac{\partial\rho}{\partial t} + \mathrm{div}\,\vec{j} = 0$

$\rho(\vec{r},t) = q\,\delta(\vec{r}-\vec{r}_0(t))$

$\vec{j}(\vec{r},t) = q\,\vec{v}(t)\,\delta(\vec{r}-\vec{r}_0(t))$

$\vec{E} = -\nabla\varphi - \frac{1}{c}\frac{\partial \bar{A}}{\partial t}$, $B = \mathrm{rot}\,\bar{A}$

$\Delta U - \frac{1}{c^2}\frac{\partial^2\varphi}{\partial t^2} = -4\pi\rho$; $\Delta\bar{A} - \frac{1}{c^2}\frac{\partial^2 A}{\partial t^2} = -\frac{4\pi}{c}j$

$\Delta G - \frac{1}{c^2}\frac{\partial^2 G}{\partial t^2} = \delta(\bar{r}-\bar{r}')\,\delta(t-t')$

$G(\bar{r}-\bar{r}', t-t') = -\frac{1}{4\pi}\frac{\delta(t-t'-R/c)}{R}$, де

$R = |\bar{r}-\bar{r}'|$

$\varphi(\bar{r},t) = \int\rho(\bar{r}',t')\frac{\delta(t-t'-R/c)}{R}\,d\bar{r}'\,dt'$

$\bar{A}(\bar{r},t) = \frac{1}{c}\int j(\bar{r}',t')\frac{\delta(t-t'-R/c)}{R}\,d\bar{r}'\,dt'$

Підставляємо та інтегруємо $\Rightarrow$

$\varphi(\bar{r},t) = q\int\frac{\delta(t-t'-R/c)}{R}\,dt'$

$\bar{A}(\bar{r},t) = \frac{q}{c}\int\bar{v}(t')\frac{\delta(t-t'-R/c)}{R}\,dt'$

№715[2]

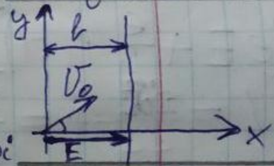
$m\ddot{\vec r} = e\vec E$, $\vec d = e\vec r \Rightarrow \ddot{\vec d} = e\ddot{\vec r} = e^2\vec E/m$

$I = (2e^2\ddot r^2)/(3c^3) = \frac{2e^4E^2}{2m^2c^3}$

Рух по осі x $a_x = \frac{eE}{m}$, по осі y $v = v_0\sin\alpha$

x(t) y(t): $x = tv_0\cos\alpha + \frac{Ee}{2m}t^2$

$y = tv_0\sin\alpha$



Знаходимо час частинки в конденсаторі

$x = l \Rightarrow t_0 = \frac{m}{eE}\left(-v_0\cos\alpha + \sqrt{v_0^2\cos^2\alpha + \frac{2Eel}{m}}\right)$

$W = It_0 = \frac{2e^3Ev_0}{3mc^3}\left(\sqrt{\frac{2eEl}{mv_0^2} + \cos^2\alpha} - \cos\alpha\right)$

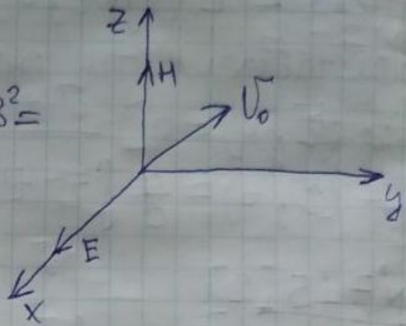
№717[2]

$m\ddot{\vec r} = e\vec E + \frac{e}{c}[\vec v\times\vec H] = eE_i + \frac{e}{c}v_yH_i - \frac{e}{c}v_xH_j$

$[\vec v\times\vec H] = \begin{vmatrix} i & j & k \\ v_x & v_y & v_z \\ 0 & 0 & H \end{vmatrix} \Rightarrow$

$\ddot r^2 = \frac{1}{m^2}(eE + \frac{e}{c}v_yH)^2 + \frac{e^2}{c^2}v_x^2B^2 =$

$= \frac{e^2}{m^2c^2}H^2\left[(v_y + \frac{E}{H}c)^2 + v_x^2\right]$



$\left.\begin{aligned} m\ddot x &= eE + \frac{e}{c}\dot y H \\ m\ddot y &= -\frac{e}{c}H\dot x \end{aligned}\right\} \Rightarrow$

$\Rightarrow \frac{d}{dt}\frac{m^2\ddot r^2}{2} = \frac{eH}{cm}\left[(eE + \frac{e}{c}\dot yH)(-\frac{e}{c}H\dot x) + (\frac{e}{c}H\dot x)\cdot\right.$

$\left.\cdot(eE + \frac{e}{y}\dot y H)\right] = 0$

$W = \frac{2\ddot d^2}{3c^2}t = \frac{2e^2}{3c^3}\ddot r^2 t = \frac{2e^4H^2}{3m^2c^5}\left[(v_{0y} + \frac{Ee}{H})^2 + v_{0x}^2\right]t$

№719[2]

$\vec E = \frac{c}{4\pi}[E\times\vec B] = \frac{c}{4\pi}[\vec E\times[\vec n\times\vec E]] = \frac{c\vec n}{4\pi}E^2 = \frac{c\vec n}{4\pi}B^2$

$\vec S = \frac{c}{4\pi}[E\times\vec B] = \frac{c}{4\pi}[E\times[\vec n\times\vec E]] = \frac{c\vec n}{4\pi}E^2 = \frac{c\vec n}{4\pi}B^2$

Вектор Пойтинга

$P = r^2 S = \frac{q^2\dot{\vec v}^2}{4\pi c^2}\sin^2\theta$, θ — кут між $\vec n$ і $\vec v$

$W_0 = \int_0^{2\pi}\int_0^{\pi} P(\theta)\sin\theta\, d\theta\, d\varphi = \frac{2}{3}\frac{q^2\dot v^2}{c^3}$

№732[2]

$$W=\int_0^{\infty} dW_\omega=\int_0^{\infty} W(\omega)\,d\omega$$

$$dW_\omega=\left(\frac{4|\ddot{d}(\omega)|^2}{3c^3}+\frac{4|\ddot{\mu}(\omega)|^2}{3c^3}+\frac{|\dddot{Q}_{\alpha\beta}(\omega)|^2}{90c^5}+\ldots\right)d\omega,$$

$\ddot{d}(\omega)$, $\ddot{\mu}(\omega)$, $\dddot{Q}_{\alpha\beta}(\omega)$ – Фур'є компоненти другиx похідних по дипольному часу $d(t)$, магнітного $\mu(t)$, квадрупольного $Q_{\alpha\beta}(t)$.

При цьому складові ряда визначають спектральну сульність електро-дипольного, магніто-дипольного, електрично-квадрупольного випромінювання

$$f(\omega)=\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{+\infty} e^{i\omega t} f(t)\,dt$$