DEPARTMENT OF PHYSICS
OSAKA IMPERIAL UNIVERSITY.

DATE ....
NO. ....

$$\left\{\Delta - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right\} A_0(\vec{r},t) = -4\pi\, \rho_{nm}(\vec{r}) \exp(-2\pi i\nu t)$$

$$\left\{\quad '' \quad\right\} \vec{A}(\vec{r},t) = -\frac{4\pi}{c}\, \vec{I}_{nm}(\vec{r}) \exp(-2\pi i\nu t)$$

$$A_0(\vec{r},t) = \int \frac{e^{iq|\vec{r}-\vec{r}'|}}{|\vec{r}-\vec{r}'|}\, \rho_{nm}(\vec{r}')\, d\vec{r}' \exp(-2\pi i\nu t)$$

$$\vec{A}(\vec{r},t) = \int \frac{e^{iq|\vec{r}-\vec{r}'|}}{|\vec{r}-\vec{r}'|}\, \vec{I}_{nm}(\vec{r})\, d\vec{r} \exp(-2\pi i\nu t)$$

$$A_0(\vec{r},t) = f_n(r,t)$$

$$\vec{A}(\vec{r},t) = \mathrm{grad}\, V. = \frac{\vec{r}}{r} f_n(r,t)$$

$$\vec{H} = \mathrm{curl}\, \vec{A} = 0$$

$$\frac{\partial \vec{E}}{\partial t} = c\, \underset{0}{\underset{\|}{\mathrm{curl}\, H}} - 4\pi \vec{I}_{nm} \exp(-2\pi i\nu t)$$

$$\vec{E} = \left(\frac{2}{i\nu}\right) \vec{I}_{nm} \exp(\quad) = -\mathrm{grad}\, A_0' \; -\frac{1}{c}\frac{\partial \vec{A}'}{\partial t}$$

$$\mathrm{curl}\, \vec{E} = -\frac{1}{c}\frac{\partial \vec{H}}{\partial t} = 0.$$

$$-\mathrm{grad}\, A_0' = \frac{1}{i\nu} \vec{I}_{nm} \exp('')$$

$$\vec{A}' = \left(\frac{-1}{2\pi\nu^2}\right) \vec{I}_{nm} \exp(\quad)$$

$\tilde{\phi}_0 \qquad \left\{ \Delta + \frac{2M}{\hbar^2}(E - V) \right\} \phi = 0$

$\phi \qquad \left\{ \Delta + \frac{2M}{\hbar^2}(E_0 - V) \right\} \tilde{\phi}_0 = 0$

$$\mathrm{div} \{ \tilde{\phi}_0 \, \mathrm{grad}\, \phi - \phi \, \mathrm{grad}\, \tilde{\phi}_0 \} + \frac{2M\Delta W}{\hbar^2} \tilde{\phi}_0 \phi = 0$$

$$\mathrm{div} \left\{ \frac{Q\hbar e}{2Mi} (\tilde{\phi}_0 \, \mathrm{grad}\, \phi - \phi \, \mathrm{grad}\, \tilde{\phi}_0) \right\}$$

$$+ Qe(-i\nu) \tilde{\phi}_0 \phi = 0 \qquad \frac{\Delta W}{\hbar} = \nu, \quad \frac{\nu}{c} = q.$$

$\mathrm{div} \; \vec{I} - i\nu \rho = 0.$

$\vec{I} = \mathrm{grad}\, V. \qquad V(\infty) = 0$

$\Delta V -$

$A_0(\vec{r}') = \int f(R) \rho \, d\vec{r}$

$\vec{A}(\vec{r}') = \frac{1}{c} \int f(R) \vec{I} \, d\vec{r} = \frac{1}{c} \int f(R) \, \mathrm{grad}\, V \, d\vec{r}$

$= \frac{1}{c} \int \mathrm{grad}\, f(R) \cdot V \, d\vec{r}$ ~~+ surface integral~~

$= -\frac{1}{c} \mathrm{grad}' \int f(R) \cdot V \, d\vec{r}$

$\mathrm{grad}' A_0(\vec{r}') = \int \mathrm{grad}' f(R) \rho \, d\vec{r} = \int \mathrm{grad}\, f \cdot \frac{1}{i\nu} \Delta V \, d\vec{r}$

$\left(\frac{-i\nu}{c}\right) \vec{A}(\vec{r}') = \frac{1}{c^2} \int \mathrm{grad}\, f \cdot (-i\nu) V \, d\vec{r}$

$-\vec{E}(\vec{r}') = \frac{1}{i\nu} \int \mathrm{grad}' f \cdot \{ \Delta V + q^2 V \} \, d\vec{r}$

$$\int f(R)\{\Delta V + \kappa^2 V\}\,d\vec{v}$$

$$= \text{surface integral} + 4\pi c\, V(\vec{r})$$

$$\int f(R)\{\Delta V + \kappa^2 V\}\,d\vec{v} \qquad + \frac{Ve}{r^2}$$

$$= \int V\{\Delta f + \kappa^2 f\}\,d\vec{v}$$

$$+ \int \operatorname{div}\{f(R)\cdot \operatorname{grad} V - V \operatorname{grad} f\}\,d\vec{v}$$

$$= -4\pi V(\vec{r}) \qquad \vec{E} = 4\pi \operatorname{grad} V, -\frac{1}{c} 4\pi \vec{I}$$

$$\vec{E} = -\operatorname{grad} A_0 - \frac{1}{c}\frac{\partial}{\partial t}\vec{A}$$

$$\operatorname{grad} \vec{E} = -\frac{4\pi}{c\nu}\vec{I}$$

$$\frac{\partial \vec{E}}{\partial t} - 4\pi\vec{I} = -\operatorname{grad}(c \operatorname{div}\vec{A}) - \frac{1}{c}\frac{\partial^2}{\partial t^2}\vec{A}$$

$$= +c\left(\Delta\vec{A} - \frac{1}{c^2}\frac{\partial^2 \vec{A}}{\partial t^2}\right)$$
