(21)

$$\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)\vec{F}-(\text{grad}-\frac{ie}{\hbar c}\vec{A})\vec{U}+\kappa U_0=0$$

$$(\text{grad}-\frac{ie}{\hbar c}\vec{A})\vec{F}+\kappa U_0=0$$

$$\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)\vec{U}+(\text{grad}-\frac{ie}{\hbar c}\vec{A})U_0+\kappa\vec{F}=0$$

$$(\text{grad}-\frac{ie}{\hbar c}\vec{A})\times\vec{U}-\kappa\vec{G}=0 \qquad (22)$$

$$+\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)^2\vec{U}+\text{grad}\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)(\text{grad}-\frac{ie}{\hbar c}\vec{A})U_0+\kappa\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)\vec{F}$$

$$+(\text{grad}-\frac{ie}{\hbar c}\vec{A})\times\{(\text{grad}-\frac{ie}{\hbar c}\vec{A})\times\vec{U}\}-\kappa(\text{grad}-\frac{ie}{\hbar c}\vec{A})\times\vec{G}=0,$$

$$\{(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0)^2\vec{U}+(\text{grad}-\frac{ie}{\hbar c}\vec{A})\times\{(\text{grad}-\frac{ie}{\hbar c}\vec{A})\times\vec{U}\}+\kappa^2\vec{U}\}$$

$$+\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)(\text{grad}-\frac{ie}{\hbar c}\vec{A})U_0=0,$$

$$[\vec{A}.[\vec{A}\vec{B}]]=\vec{A}(\vec{A})\vec{B}-(\vec{A}\vec{A})B$$

$$\left\{\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)^2-(\text{grad}-\frac{ie}{\hbar c}\vec{A})^2+\kappa^2\right\}\vec{U}$$

$$+(\text{grad}-\frac{ie}{\hbar c}\vec{A},(\text{grad}-\frac{ie}{\hbar c}\vec{A})\vec{U})+\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)(\text{grad}-\frac{ie}{\hbar c}\vec{A})U_0=0$$

$$+\frac{ie}{\hbar c}\vec{E}_x U_0$$

x-Comp.

$$\left(\frac{\partial}{\partial x}-\frac{ie}{\hbar c}A_x\right)\left(\frac{\partial}{\partial x}-\frac{ie}{\hbar c}A_x\right)U_x+\left(\frac{\partial}{\partial y}-\frac{ie}{\hbar c}A_y\right)\left(\frac{\partial}{\partial x}-\frac{ie}{\hbar c}A_x\right)U_y$$

$$+\left(\frac{\partial}{\partial z}-\frac{ie}{\hbar c}A_z\right)\left(\frac{\partial}{\partial x}-\frac{ie}{\hbar c}A_x\right)U_z+(\text{grad}-\frac{ie}{\hbar c}\vec{A})\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)U_0$$

$$=\left(\frac{\partial}{\partial x}-\frac{ie}{\hbar c}A_x\right)\{(\text{grad}-\frac{ie}{\hbar c}\vec{A})\vec{U}\}+\frac{ie}{\hbar c}(H_z U_y-H_y U_z)\cdots$$

$$=\frac{1}{\kappa}\left(\frac{\partial}{\partial x}-\frac{ie}{\hbar c}A_x\right)\left\{(\text{grad}\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)\vec{F}-(\text{grad}-\frac{ie}{\hbar c}\vec{A})\left((\text{grad}-\frac{ie}{\hbar c})\times\vec{G}\right)\right.$$

$$\left.-\frac{ie}{\hbar c}(H\times U)_x\right\}+\frac{ie}{\hbar c}\vec{E}_x U_0$$

$$-\frac{1}{\kappa}\left(\frac{1}{c}\frac{\partial}{\partial t}+\frac{ie}{\hbar c}A_0\right)\left(\frac{\partial}{\partial x}-\frac{ie}{\hbar c}A_x\right)(\text{grad}-\frac{ie}{\hbar c}\vec{A})\vec{F}$$

$$-\frac{ie}{\hbar c}(H \times \dot{U})_x + \frac{ie}{\hbar c} E_x U_0$$

$$-\frac{1}{\kappa}\left(\frac{\partial}{\partial x} - \frac{ie}{\hbar c}A_x\right)\left\{\left(\frac{ie}{\hbar c}\right)\vec{E}\vec{F} -\right.$$

$$-\frac{1}{\kappa}\left(\frac{\partial}{\partial x} - \frac{ie}{\hbar c}A_x\right)\left\{\left[\left(\frac{\partial}{\partial x} - \frac{ie}{\hbar c}A_x\right)\left\{\left(\frac{\partial}{\partial y} - \frac{ie}{\hbar c}A_y\right)G_z - \left(\frac{\partial}{\partial z} - \frac{ie}{\hbar c}A_z\right)G_y\right\}\right.\right.$$

$$+\left(\frac{\partial}{\partial y} - \frac{ie}{\hbar c}A_y\right)\left\{\left(\frac{\partial}{\partial z} - \frac{ie}{\hbar c}A_z\right)G_x - \left(\frac{\partial}{\partial x} - \frac{ie}{\hbar c}A_x\right)G_z\right\}$$

$$+$$

$$= -\frac{1}{\kappa}\left(\frac{\partial}{\partial x} - \frac{ie}{\hbar c}A_x\right)\left[-\frac{ie}{\hbar c}H_z G_z\right.$$

$$= \left(\frac{ie}{\hbar c}\right)\frac{1}{\kappa}\left(\frac{\partial}{\partial x} - \frac{ie}{\hbar c}A_x\right) HG.$$

$$-\frac{ie}{\hbar c}\left[\vec{H} \times \vec{U} - \vec{E}U_0 + \frac{1}{\kappa}\left(\mathrm{grad} - \frac{ie}{\hbar c}\vec{A}\right)(\vec{E}\vec{F} - \vec{H}\vec{G})\right]$$