N2

$$\vec{H} = \nabla \times \vec{A} \qquad \vec{A} = \frac{e}{c}\frac{\vec{v}}{R - \frac{\vec{v}\vec{R}}{c}}$$

$$\vec{H} = \nabla \times \left(\frac{e}{c}\frac{\vec{V}}{R - \frac{\vec{v}\vec{R}}{c}}\right) = \frac{e}{c}\frac{1}{R - \frac{\vec{v}\vec{R}}{c}}(\nabla \times \vec{V}) + \frac{e}{c}\left(\nabla \frac{1}{R - \frac{\vec{v}\vec{R}}{c}}\right) \times \vec{v} =$$

$$= \frac{e}{c}\frac{(\nabla \times \vec{V})}{R - \frac{\vec{v}\vec{R}}{c}} - \frac{e}{c}\frac{1}{\left(R - \frac{\vec{v}\vec{R}}{c}\right)^2}\nabla\left(R - \frac{\vec{v}\vec{R}}{c}\right) \times \vec{V} \ominus$$

$$\nabla \times \vec{V} = -\dot{\vec{V}} \times (\nabla t') = \frac{-\vec{R} \times \dot{\vec{V}}}{c\left(R - \frac{\vec{v}\vec{R}}{c}\right)}$$

$$\ominus - \frac{e}{c^2}\frac{\vec{R} \times \dot{\vec{V}}}{\left(R - \frac{\vec{v}\vec{R}}{c}\right)} + \frac{e}{c}\frac{\vec{V} \times \left(\nabla\left(R - \frac{\vec{v}\vec{R}}{c}\right)\right)}{\left(R - \frac{\vec{v}\vec{R}}{c}\right)}$$

$$\nabla\left(R - \frac{\vec{v}\vec{R}}{c}\right) = \frac{\vec{R}}{R} - \frac{\vec{V}}{c} + \left(\frac{\vec{v}\vec{R}}{R} + \frac{\dot{\vec{v}}\vec{R}}{c} - \frac{\vec{v}^2}{c}\right)\frac{\vec{R}}{c\left(R - \frac{\vec{v}\vec{R}}{c}\right)}$$

$$\vec{H} = \frac{\vec{R} \times \vec{E}}{R} = \vec{n} \times \vec{E}$$

N3

$$\vec{E} = \frac{e}{R\left(1 - \frac{\vec{n}\vec{v}}{c}\right)^3}\left[\frac{1}{c^2}\vec{n} \times \left(\left(\vec{n} - \frac{\vec{v}}{c}\right) \times \dot{\vec{V}}\right) + \frac{1}{R}\left(\vec{n} - \frac{\vec{V}}{c}\right)\left(1 - \frac{v^2}{c^2}\right)\right]$$

$$R \to \infty \quad v \ll c: \qquad \vec{E} = \frac{e}{c^2 R}\vec{n} \times [\vec{n} \times \dot{\vec{V}}]$$

$$|\vec{E}| = \frac{e\dot{v}}{c^2 R}$$

$$W = \frac{E^2 + H^2}{8\pi} = \frac{2E^2}{8\pi} = \frac{E^2}{4\pi} = \frac{1}{4\pi}\left(\frac{e\dot{v}}{c^2 R}\right)^2$$

N4

$$\vec{v}(t) = \begin{cases} -V_0 + \frac{4V_0}{T} t & t \in [0; \frac{T}{2}] \\ V_0 - \frac{4V_0}{T}(t - \frac{T}{2}) & t \in [\frac{T}{2}; T] \end{cases}$$

$$\dot{\vec{V}} = \begin{pmatrix} \pm \frac{4V_0}{T} \\ 0 \\ 0 \end{pmatrix}$$

$V \ll c \quad r \to \infty: \quad \vec{S} = \frac{e^2}{c^3} \frac{1}{4\pi r^2} \left(\frac{4V_0}{T}\right)^2 (1 - \cos^2\varphi \cdot \sin^2\theta)\vec{n}$

$$\langle P \rangle_T = \frac{e^2}{c^3} \frac{1}{4\pi} \left(\frac{4V_0}{T}\right)^2 \int_0^{\pi}\int_0^{2\pi} (1 - \cos^2\varphi \cdot \sin^2\theta) \cdot \sin\theta \, d\varphi \, d\theta =$$

$$= \frac{2}{3} \frac{e^2}{c^3} \left(\frac{4V_0}{T}\right)^2$$

N6

$$\nabla \cdot \vec{A} + \frac{1}{c}\frac{\partial \varphi}{\partial t} = \nabla\left(\frac{e}{c} \frac{\vec{V}}{R - \frac{\vec{V}\vec{R}}{c}}\right) + \frac{1}{c}\frac{\partial}{\partial t}\left(\frac{e}{c(R - \frac{\vec{V}\vec{R}}{c})}\right) =$$

$$= \frac{e\gamma^2}{cR^2}\left[\frac{R}{\gamma} \nabla \cdot \vec{V} - \nabla \cdot \left(R - \frac{\vec{V}\vec{R}}{c}\right) \cdot \vec{V} - \frac{\partial}{\partial t}\left(R - \frac{\vec{V}\vec{R}}{c}\right)\right] =$$

$$= \frac{e\gamma^2}{cR^2}\left[\frac{R}{\gamma} \dot{\vec{V}} \cdot \nabla t' - \vec{n}\gamma\left(1 - \frac{\vec{V}^2}{c^2}\right)\vec{V} + \frac{\vec{V}^2}{c} - \gamma \frac{\vec{n}(\vec{R} \cdot \dot{\vec{V}})\vec{V}}{c^2} + \right.$$

$$\left. + (\vec{n}\vec{V})\gamma - \gamma \frac{\vec{V}^2}{c} + \gamma \frac{\vec{R} \cdot \dot{\vec{V}}}{c}\right] = 0$$

N5

$$\vec{V} = \overrightarrow{const} \Rightarrow \vec{E} = \frac{e\gamma^3}{R^2}\left(\vec{n} - \frac{\vec{V}}{c}\right)\left(1 - \frac{\vec{V}^2}{c^2}\right)\Bigg|_{t=t'}$$

$$\vec{S} = \vec{r} - \vec{r}_0(t) = \vec{r} - \vec{r}_0(t') - \vec{V}(t-t') = \vec{R} - \vec{V}\frac{R}{c} =$$

$$= R\left(\vec{n} - \frac{\vec{V}}{c}\right)$$

$$\frac{\gamma}{R} = \frac{1}{R\left(1 - \frac{\vec{n}\vec{V}}{c}\right)} = \frac{1}{\vec{n}\,R\left(\vec{n} - \frac{\vec{V}}{c}\right)} = \frac{1}{\vec{n}\cdot\vec{S}} = \frac{1}{S\cdot\cos(\widehat{\vec{n}\,\vec{S}})}$$

$$\frac{V\frac{R}{c}}{\sin(\widehat{\vec{n}\,\vec{S}})} = \frac{R}{\sin(\pi-\theta)} \Rightarrow \sin(\widehat{\vec{n}\,\vec{S}}) = \frac{V}{c}\cos\theta$$

$$\Rightarrow \cos(\widehat{\vec{n}\,\vec{S}}) = \sqrt{1 - \frac{V^2}{c^2}\sin^2\theta}$$

$$\vec{E} = \frac{e\gamma^3}{R^2}\left(n - \frac{\vec{V}}{c}\right)\left(1 - \frac{V^2}{c^2}\right) = e\left(\frac{\gamma}{R}\right)^3\vec{S}\cdot\left(1 - \frac{V^2}{c^2}\right) =$$

$$= \frac{e\vec{S}}{S^3}\,\frac{1 - \frac{V^2}{c^2}}{\left(1 - \frac{V^2}{c^2}\sin^2\theta\right)^{\frac{3}{2}}}$$