HW 9.1

Monday, March 15, 2021 8:20 PM

$$\omega^\mu = \frac{u^\mu}{c}$$

$$\frac{d\omega}{d\tau} = \left(\gamma^4 \vec{\beta}\cdot\dot{\vec{\beta}},\ \gamma^4(\vec{\beta}\cdot\dot{\vec{\beta}})\vec{\beta} + \gamma^2\dot{\vec{\beta}}\right)$$

$$\left(\frac{d\omega}{d\tau}\right)^2 = \frac{d\omega^\mu}{d\tau}\cdot\frac{d\omega_\mu}{d\tau}$$

$$\boxed{\gamma = \sqrt{\frac{1}{1-\beta^2}}}$$

$$= \gamma^8(\vec{\beta}\cdot\dot{\vec{\beta}})^2 - \gamma^8(\vec{\beta}\cdot\dot{\vec{\beta}})^2\beta^2 + \gamma^4\dot{\beta}^2 - 2\gamma^6(\vec{\beta}\cdot\dot{\vec{\beta}})^2$$

$$= \gamma^8(\vec{\beta}\cdot\dot{\vec{\beta}})^2 - \gamma^8(\vec{\beta}\cdot\dot{\vec{\beta}})(1-\gamma^{-2}) + \gamma^4\dot{\beta}^2 - 2\gamma^6(\vec{\beta}\cdot\dot{\vec{\beta}})^2$$

$$= -\gamma^6(\vec{\beta}\cdot\dot{\vec{\beta}})^2 - \gamma^6(1-\beta^2)\dot{\vec{\beta}}^2$$

$$= \gamma^6\left[-(\vec{\beta}\cdot\dot{\vec{\beta}})^2 - (\vec{\beta}\cdot\dot{\vec{\beta}})^2 + \beta^2\dot{\beta}^2\right]$$

$$= \gamma^6\left[\ldots\right]$$

$= \gamma^6 L(\beta \times \beta) - \beta$]