

$$\begin{aligned}
\frac{E_3'}{c} &= F'^{30} = \Lambda^3_\alpha \Lambda^0_\beta F^{\alpha\beta} \\
&= \Lambda^3_3 \left(\Lambda^0_0 F^{30} + \Lambda^0_1 F^{31} \right) \\
&= \gamma \frac{E_3}{c} - \gamma \beta (-B_2) = \gamma \left(\frac{E_3}{c} + B_2 \right)
\end{aligned}$$

$$\begin{aligned}
B_3' &= F'^{21} = \Lambda^2_\alpha \Lambda^1_\beta F^{\alpha\beta} \\
&= \Lambda^2_2 \left(\Lambda^1_0 F^{20} + \Lambda^1_1 F^{21} \right) \\
&= \left(-\gamma \beta \frac{E_2}{c} + \gamma B_3 \right) = \gamma \left(B_3 - \beta \frac{E_2}{c} \right)
\end{aligned}$$