

Homework 3

1. French, 6-2, p. 200.
2. French, 6-4, p. 200.
3. You already know the velocity addition formula,

$$u = \frac{u' + v}{1 + (\frac{u'}{c})(\frac{v}{c})}.$$

Here, u' and v have their normal meanings. Show that the Lorentz factor γ_u appropriate for u is

$$\gamma_u = \frac{1 + \beta_{u'}\beta_v}{\sqrt{(1 - \beta_{u'}^2)(1 - \beta_v^2)}} = \gamma_{u'}\gamma_v(1 + \beta_{u'}\beta_v),$$

where $\beta_{u'} = u'/c$ and $\beta_v = v/c$.

4. Using the hints I provided in class and the results of problem (3), show that

$$P = \begin{pmatrix} E \\ p_x c \\ p_y c \\ p_z c \end{pmatrix}$$

is a 4-vector.