The Lorentz Transformation at the Maximum Velocity for a Mass

Espen Gaarder Haug*
Norwegian University of Life Sciences

September 12, 2016

Abstract

Haug [1, 2] has recently shown there is a speed limit for fundamental particles just below the speed of light given by $v_{max} = c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}$. This speed limit means that the mass of a fundamental particle not will go towards infinity as v approaches c in the Einstein relativistic mass equation. The relativistic mass limit for a fundamental particle is the Planck mass. In this paper we use the same velocity limit in the Lorentz transformation. This leads to what we think could be significant results that we will discuss in more detail later on. This time we only present the derivations.

Key words: Lorentz transformation, maximum velocity, fundamental particles, Planck length, reduced Compton wavelength.

1 The Lorentz Transformation at the Maximum Velocity for Fundamental Particles

The Lorentz [3, 4] transformation is given by the following equation; see also [5], [6] and [7].

$$\hat{x} = \frac{x - vt}{\sqrt{1-\frac{v^2}{c^2}}}, \qquad \hat{y} = y \qquad \hat{z} = z, \qquad \hat{t} = \frac{t - \frac{vx}{c^2}}{\sqrt{1-\frac{v^2}{c^2}}}.$$

Here we will look at the limit of the Lorentz transformation for fundamental particles based on the maximum velocity recently given by Haug. The length transformation for the reduced Compton wavelength must be

$$\hat{x} = \frac{\bar{\lambda} - tv}{\sqrt{1-\frac{v^2}{c^2}}} \tag{1}$$

In the case where a fundamental particle moves at the maximum velocity v_{max} at which it can travel before it bursts into energy we get:

$$\begin{aligned}
\hat{x} &= \frac{\bar{\lambda} - tv_{max}}{\sqrt{1-\frac{v_{max}^2}{c^2}}} \\
\hat{x} &= \frac{\bar{\lambda} - \frac{\bar{\lambda}}{c}c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{\sqrt{1-\frac{\left(c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}\right)^2}{c^2}}} \\
\hat{x} &= \frac{\bar{\lambda} - \frac{\bar{\lambda}}{c}c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{\frac{l_p}{\bar{\lambda}_e}} \\
\hat{x} &= \frac{\bar{\lambda} - \bar{\lambda}\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{\frac{l_p}{\bar{\lambda}}} \\
\hat{x} &= \frac{\bar{\lambda}^2 - \bar{\lambda}^2\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{l_p}
\end{aligned} \tag{2}$$

*e-mail espenhaug@mac.com. Thanks to Victoria Terces for helping me edit this manuscript. Also thanks AvT for useful tips on using series expansion for $\sqrt{1-x}$.

We can estimate $\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}$ by using a series expansion, here given by the first three terms:

$$\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}} \approx 1-\frac{l_p^2}{\bar{\lambda}^2}\frac{1}{2}-\frac{l_p^4}{\bar{\lambda}^4}\frac{1}{8}-\frac{l_p^6}{\bar{\lambda}^6}\frac{1}{16}... \tag{3}$$

It can be shown that the first term of the series expansion gives a very accurate result and that further terms are negligible. Replacing the series expansion into the equation 2 we get

$$\begin{aligned}
\hat{x} &\approx \frac{\bar{\lambda}^2-\bar{\lambda}^2\left(1-\frac{l_p^2}{\bar{\lambda}^2}\frac{1}{2}\right)}{l_p} \\
\hat{x} &\approx \frac{\bar{\lambda}^2-\bar{\lambda}^2+l_p^2\frac{1}{2}}{l_p} \\
\hat{x} &\approx \frac{1}{2}l_p
\end{aligned} \tag{4}$$

In the opposite direction we get

$$\begin{aligned}
\hat{x} &= \frac{\bar{\lambda}+tv_{max}}{\sqrt{1-\frac{v_{max}^2}{c^2}}} \\
\hat{x} &= \frac{\bar{\lambda}+\frac{\bar{\lambda}}{c}c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{\sqrt{1-\frac{\left(c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}\right)^2}{c^2}}} \\
\hat{x} &= \frac{\bar{\lambda}+\bar{\lambda}\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{\frac{l_p}{\bar{\lambda}_e}} \\
\hat{x} &= \frac{\bar{\lambda}^2+\bar{\lambda}^2\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{l_p} \\
\hat{x} &\approx \frac{\bar{\lambda}^2+\bar{\lambda}^2\left(1-\frac{l_p^2}{\bar{\lambda}^2}\frac{1}{2}\right)}{l_p} \\
\hat{x} &\approx \frac{\bar{\lambda}^2+\bar{\lambda}^2-l_p^2\frac{1}{2}}{l_p} \\
\hat{x} &\approx 2\frac{\bar{\lambda}^2}{l_p}-\frac{1}{2}l_p
\end{aligned} \tag{5}$$

The round trip distance as observed from the other frame is

$$\frac{\bar{\lambda}-tv_{max}}{\sqrt{1-\frac{v_{max}^2}{c^2}}}+\frac{\bar{\lambda}+tv_{max}}{\sqrt{1-\frac{v_{max}^2}{c^2}}}=\frac{1}{2}l_p+2\frac{\bar{\lambda}^2}{l_p}-\frac{1}{2}l_p=2\frac{\bar{\lambda}^2}{l_p} \tag{6}$$

Similar for the Lorentz time transformation we get:

$$\begin{aligned}
\hat{t} &= \frac{t-\frac{\bar{\lambda}v_{max}}{c^2}}{\sqrt{1-\frac{v_{max}^2}{c^2}}} \\
\hat{t} &= \frac{\frac{\bar{\lambda}}{c}-\frac{\bar{\lambda}c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{c^2}}{\sqrt{1-\frac{\left(c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}\right)^2}{c^2}}} \\
\hat{t} &= \frac{\frac{\bar{\lambda}}{c}-\frac{\bar{\lambda}\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{c}}{\frac{l_p}{\bar{\lambda}}}
\end{aligned} \tag{7}$$

Again, we use the series expansion for $\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}$ and get

$$\hat{t} \approx \frac{\frac{\bar{\lambda}^2}{c} - \frac{\bar{\lambda}^2\left(1-\frac{l_p^2}{\bar{\lambda}^2}\frac{1}{2}\right)}{c}}{l_p}$$

$$\hat{t} \approx \frac{\frac{\bar{\lambda}^2}{c} - \frac{\bar{\lambda}^2}{c} + \frac{l_p^2}{c}\frac{1}{2}}{l_p}$$

$$\hat{t} \approx \frac{1}{2}\frac{l_p}{c} \tag{8}$$

For a signal going in the opposite direction we get

$$\hat{t} = \frac{t + \frac{\bar{\lambda} v_{max}}{c^2}}{\sqrt{1-\frac{v_{max}^2}{c^2}}}$$

$$\hat{t} = \frac{\frac{\bar{\lambda}}{c} + \frac{\bar{\lambda} c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{c^2}}{\sqrt{1-\frac{\left(c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}\right)^2}{c^2}}}$$

$$\hat{t} = \frac{\frac{\bar{\lambda}}{c} + \frac{\bar{\lambda}\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}}{c}}{\frac{l_p}{\bar{\lambda}}}$$

$$\hat{t} \approx \frac{\frac{\bar{\lambda}^2}{c} + \frac{\bar{\lambda}^2\left(1-\frac{l_p^2}{\bar{\lambda}^2}\frac{1}{2}\right)}{c}}{l_p}$$

$$\hat{t} \approx \frac{\frac{\bar{\lambda}^2}{c} + \frac{\bar{\lambda}^2}{c} - \frac{l_p^2}{c}\frac{1}{2}}{l_p}$$

$$\hat{t} \approx 2\frac{\bar{\lambda}^2}{l_p c} - \frac{1}{2}\frac{l_p}{c} \tag{9}$$

The round trip time is given by

$$\frac{t - \frac{\bar{\lambda} v_{max}}{c^2}}{\sqrt{1-\frac{v_{max}^2}{c^2}}} + \frac{t + \frac{\bar{\lambda} v_{max}}{c^2}}{\sqrt{1-\frac{v_{max}^2}{c^2}}} = \frac{1}{2}\frac{l_p}{c} + 2\frac{\bar{\lambda}^2}{l_p c} - \frac{1}{2}\frac{l_p}{c} = 2\frac{\bar{\lambda}^2}{l_p c} \tag{10}$$

References

[1] E. G. Haug. The Planck mass particle finally discovered! The true God particle! Good bye to the point particle hypothesis! *http://vixra.org/pdf/1607.0496v6.pdf*, 2016.

[2] E. G. Haug. A new solution to Einstein's relativistic mass challenge based on maximum frequency. *http://vixra.org/abs/1609.0083*, 2016.

[3] H. A. Lorentz. Electromagnetic phenomena in a system moving with any velocity less than that of light. *Proc. Acad. Scientific, Amsterdam*, (6), 1904.

[4] H. Poincaré. On the dynamics of the electron. *Comptes Rendus*, 1905.

[5] A. Einstein. On the electrodynamics of moving bodies. *Annalen der Physik, English translation by George Barker Jeffery 1923*, (17), 1905.

[6] J. J. Larmor. *Aether and Matter: A Development of the Dynamical Relations of the Aether to Material Systems*. Cambridge University Press, 1900.

[7] E. G. Haug. *Unified Revolution: New Fundamental Physics.* Oslo, E.G.H. Publishing, 2014.