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Neutrino Relativistic Energy in Heracletean World (Second Side of Fragment)

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Abstract: *The relativistic energy being in inverse proportion to the superluminal speed can justify a great energy of neutrinos obeying Heracletean dynamics nevertheless their ground mass is non-zero or zero.*

Keywords: *Heracletean dynamics, ground and relativistic mass, limited kinetic and limitless slowdown energy, speed relations between superluminal ground, minimal and maximal speed, unpaired slowness and paired speed, zero and non-zero neutrino ground mass*

1. Introduction

In an ordinary mechanical dynamic (Newtonian or modified Einsteinian) expressed as F = dp/dt the energy is a mirror of speed. In Heracletean dynamics expressed as F = dp/dt + d(k/p)/dt the energy is a mirror of the inverse speed, let us say, slowness, too. So, it is zero at non-zero ground speed; infinite at rest and upside limited at some maximal speed characteristic for any finite ground mass. The maximal energy as a consequence of speed belongs to a pair of extreme speeds (minimal and maximal). On the other hand the energy as a consequence of slowness is limitless and belongs to the unpaired speed being lower than the minimal paired speed. The subject of interest of this paper is to show the relations between the concerned speeds to evaluate the neutrino relativistic energy in Heracletean dynamics more precisely than before [1].

2. The Speed Relations

It can be examined that in Heracletean dynamics [1] the pair of the extreme speeds expressed in the units of the speed of light – $a_{minimal}$ and $a_{maximal}$ – is related independently of the dynamics constant k (see appendix).

The minimal speed:

$$a_{minimal} = a_{maximal} - \frac{1}{a_{maximal}}. \tag{1}$$

The maximal speed:

$$a_{maximal} = \frac{a_{minimal} + \sqrt{(a_{minimal})^2 + 4}}{2}. \tag{2}$$

And the difference of the extreme speeds:

$$\Delta a_{extreme} = a_{maximal} - a_{minimal} = \frac{1}{a_{maximal}}. \tag{3}$$

The extreme speeds are independently of the dynamics constant k related to the ground speed a_{ground}, too.

The maximal speed:

$$a_{maximal} = \sqrt{\frac{1}{e^{\frac{1}{a_{ground}^2}} - 1} + 1}. \tag{4}$$

The minimal speed:

$$a_{minimal} = \sqrt{\frac{1}{e^{\frac{1}{a_{ground}^2}} - 1} + 1} - \frac{1}{\sqrt{\frac{1}{e^{\frac{1}{a_{ground}^2}} - 1} + 1}}. \tag{5}$$

Vice versa, the ground speed is related to the maximal speed:

$$a_{ground} = \sqrt{\frac{1}{ln(\frac{1}{(a_{maximal})^2 - 1} + 1)}}. \tag{6}$$

Also the ground speed is related to the minimal speed:

$$a_{ground} = \sqrt{\frac{1}{ln(\frac{1}{\left(\frac{a_{minimal} + \sqrt{(a_{minimal})^2 + 4}}{2}\right)^2 - 1} + 1)}}. \tag{7}$$

Any unpaired speed as a mirror of slowness is smaller than minimal paired speed:

$$a_{unpaired} < a_{minimal}. \tag{8}$$

3. THE MASS SPEED RELATIONS

The dynamics constant k only determines what mass belongs to the specific pair of extreme speeds [1]:

$$m_{maximal} = \frac{1}{\sqrt{a_{minimal} \cdot a_{maximal}}} \frac{\sqrt{k}}{c}. \tag{9}$$

What mass belongs to the ground speed[1]:

$$m_{ground} = \frac{\sqrt{k}}{a_{ground} c}. \tag{10}$$

And what mass belongs to any speed a even the unpaired one[1]:

$$m_{relativistic}^2 c^2 a^2 = e^{\frac{m_{ground}^2 c^2 - k(1 - lnk) + m_{relativistic}^2 c^2 (a^2 - 1)}{k}}. \tag{11}$$

For instance, at luminal speed $a = 1$ the next pair of relativistic and ground mass is given:

$$m_{relativistic}^2 c^2 = e^{\frac{m_{ground}^2 c^2 - k(1 - lnk)}{k}}. \tag{12}$$

And for the zero ground mass at the luminal speed we have:

$$m_{relativistic}\left(a = 1, m_{ground} = 0\right) = \frac{\sqrt{e^{lnk-1}}}{c}. \tag{13}$$

As well as for all enough light ground masses $m_{ground}^2 c^2 \ll -k(1 - lnk)$ at the luminal speed holds:

$$m_{relativistic}\left(a = 1, m_{ground} \approx 0\right) \approx \frac{\sqrt{e^{lnk-1}}}{c}. \tag{14}$$

4. THE NEUTRINO MASS AND SPEED

The neutrino mass and speed are illustrated with the help of the above equations applying the speculated value of the dynamics constant $k = 6{,}2723514\, x10^{-46} kg^2 m^2 s^{-2}$ in the case of the neutrino zero ground mass $m_{ground} = 0$ as well as non-zero ground mass $m_{ground} = 0.02\ eV/c^2$. The results are presented in Table1.

Table1. *The illustration of neutrino mechanical characteristics in Heracletean world*

m_{ground}	0	$0.02\ eV/c^2$
$m_{relativistic}$	$28.4\ keV/c^2$	$28.4\ keV/c^2$
a_{ground}	∞	46862.5
$a_{minimal}$	∞	46 862.499 984
$a_{maximal}$	∞	46 862.500 005
$\Delta a_{extreme}$	0	0.000 021
$a_{slowdown}$	$< \infty$	$<$ 46 862.499 984
$a_{relativistic}$	1	1

We can see from Table1 that obeying Heracletean dynamics the great neutrino relativistic mass and subluminal speed could be only of the slowdown energy origin, i.e. of the energy being in inverse proportion to the unpaired speed. Since the ground speed as well as both extreme speeds of such a small ground mass are superluminal. The approximate estimation made on the first side of fragment[1] that the neutrino ground mass could be super small but non-zero is now replaced by the exact estimation that it could be even zero and of course possessing the relativistic mass in inverse proportion to the speed.

5. Conclusion

Anyway – being of zero or non-zero ground mass – the neutrino should slow down the superluminal speed gaining enough energy to become visible in Heracletean world.

Reference

[1] Janez Špringer, (2019). Neutrino Relativistic Energy in Heracletean World. International Journal of Advanced Research in Physical Science (IJARPS) 6(4), pp 17-19, 2019.

Appendix

For the maximal speed holds [1]:

$$a_{maximal} = \sqrt{1 + \frac{k}{e^{\frac{c^2}{k^2}+lnk} - k}}. \tag{15a}$$

So we can write:

$$e^{\frac{c^2}{k^2}+lnk} - k = \frac{k}{a_{maximal}^2 - 1}. \tag{15b}$$

And

$$\sqrt{1 + \frac{k}{e^{\frac{c^2}{k^2}+lnk} - k}} = a_{maximal}. \tag{15c}$$

For the minimal speed holds [1]:

$$a_{minimal} = \frac{k}{\left(e^{\frac{c^2}{k^2}+lnk} - k\right)\sqrt{1 + \frac{k}{e^{\frac{c^2}{k^2}+lnk} - k}}}. \tag{16a}$$

So applying (15b) and (15c) we can write:

$$a_{minimal} = \frac{k}{\left(\frac{k}{a_{maximal}^2 - 1}\right) a_{maximal}} = \frac{a_{maximal}^2 - 1}{a_{maximal}}. \tag{16b}$$

And finally:

$$a_{minimal} = a_{maximal} - \frac{1}{a_{maximal}}. \tag{1}$$

Dedication

This fragment is dedicated to my dear high school friends from Prva gimnazija Maribor (1967-1971). Since one can never forget his first love.

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