International Journal of Advanced Research in Physical Science (IJARPS)
Volume 12, Issue 07, 2025, PP 1-4
ISSN (Online)-2349-7882
www.arcjournals.org

Golden Ratio near Border of Elliptic and Hyperbolic Universe

Janez Špringer*

Cankarjeva cesta 2, 9250 Gornja Radgona, Slovenia, EU

Corresponding Author:** ***Janez Špringer, *Cankarjeva cesta 2, 9250 Gornja Radgona, Slovenia, EU*

Abstract: *Parallel worlds are an option in Heraclitean dynamics.*

Keywords: *Heraclitean dynamics, minimal and maximal relativistic speed, free speed and ground mass, dynamics constant, golden ratio, elliptic and parallel hyperbolic infinite universe*

1. Introduction

In Heraclitean dynamics the minimal relativistic speed and maximal relativistic speed (expressed in units of speed of light) are related as follows [1]:

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

Both concerned speeds are dependent on the ground mass of the object m_{ground} and the dynamics constant k

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

And

$$a_{maximal} = \sqrt{\frac{1}{e^{\frac{m_{ground}^2 c^2}{k}} - 1} + 1}. \tag{3}$$

For instance, infinite ground mass has zero minimal relativistic speed

$$a_{minimal}(\infty) = \sqrt{\frac{1}{e^{\infty} - 1} + 1} - \frac{1}{\sqrt{\frac{1}{e^{\infty} - 1} + 1}} = 0. \tag{4}$$

As well as infinite ground mass has luminal maximal relativistic speed

$$a_{maximal}(\infty) = \sqrt{\frac{1}{e^{\infty} - 1} + 1} = 1. \tag{5}$$

This could mean that our universe - since the maximal speed being luminal [2]- has infinite ground mass. But this finding does not prohibit the possibility that some object with finite mass could move at luminal speed, because luminal minimal relativistic speed exists, too.

2. The Ground Mass of Object Possessing the Luminal Minimal Relativistic Speed

a) Let the minimal relativistic speed of an object in infinite universe is luminal

$$a_{minimal} = 1. \tag{9}$$

b) The maximal relativistic speed is then in the golden ratio (GR) with the minimal relativistic speed (See appendix 1)

$$a_{maximal} = \frac{1+\sqrt{5}}{2} = 1.618\ldots = (GR). \tag{10}$$

c) The related free speed reflects the (GR) (See appendix 2)

$$a_{free} = \frac{1}{\sqrt{\ln(GR)}} = 1.441\ldots \tag{11}$$

d) And the related ground mass is determined by the GR and the dynamics constant k (See appendix 3)

$$m_{ground} = \frac{\sqrt{k}}{a_{free}\, c} = \frac{\sqrt{k}}{c}\sqrt{\ln(GR)}\,. \tag{12}$$

e) Applying the dynamics constant for the ordinary matter $k = hc$ [3] (where h is Planck's constant and c is the speed of light) the next related ground mass is calculated

$$m_{ground} = \frac{\sqrt{hc}}{c}\sqrt{\ln(GR)} = 0.69369\sqrt{\frac{h}{c}} = 1.031\ x\ 10^{-21} kg. \tag{13}$$

Lighter ground masses than the above belong to the superluminal universe[4].

3. Conclusion

The obtained result could mean that particles lighter than $m_{ground} = 7.154\ x\ 10^{-22} kg$ obeying Heraclitean dynamics cannot exist in the elliptic universe reserved for subluminal particles with masses heavier than $\sqrt{\frac{h}{c}}$ [4]. But they can exist in the parallel hyperbolic universe reserved for superluminal particles with masses lighter than $\sqrt{\frac{h}{c}}$ [4]. Since

$$\ln(GR)\sqrt{\frac{h}{c}} = 0.481\sqrt{\frac{h}{c}} < \sqrt{\frac{h}{c}}. \tag{14}$$

The last particle in the hyperbolic universe has zero ground mass with infinite free speed as well as infinite minimal relativistic speed and infinite maximal relativistic speed. (See appendix 5)

Dedication

To the Golden Ratio

References

[1] Janez Špringer, (2019). Neutrino Relativistic Energy in Heraclitean World (Second Side of Fragment). International Journal of Advanced Research in Physical Science (IJARPS) 6(5), pp.1-3, 2019.

[2] ChatGPT. Retrieved September 2025

[3] (2019). Relativistic Constants of Variant Ordinary Matter. International Journal of Advanced Research in Physical Science (IJARPS) 6(11), pp.38-40, 2019

[4] Janez Špringer (2021). Sphere in Heraclitean Dynamics. International Journal of Advanced Research in Physical Science (IJARPS) 8(3), pp.23-28 2021.

Appendix 1

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

At $a_{minimal} = 1$ and $a_{maximal} = x$ we have

$$1 = x - \frac{1}{x}\,. \tag{b}$$

By rearranging we obtain the quadratic equation

$$x^2 - x - 1 = 0. \tag{c}$$

With a positive result

$$x = \frac{1+\sqrt{1+4}}{2} = \frac{1+\sqrt{5}}{2} = 1.618 \ldots = (GR). \qquad (d)$$

So, the related maximal speed equals the golden ratio

$$a_{maximal} = (GR). \qquad (e)$$

APPENDIX 2

$$a_{maximal} = \sqrt{\frac{1}{e^{\frac{m_{ground}^2 c^2}{k}} - 1} + 1}. \qquad (f)$$

For $a_{maximal} = (GR)$ and $\frac{m_{ground}^2 c^2}{k} = x$ we have

$$(GR) = \sqrt{\frac{1}{e^x - 1} + 1}. \qquad (g)$$

Rearranging we get

$$(GR)^2 - 1 = \frac{1}{e^x - 1} \rightarrow \frac{1}{(GR)^2 - 1} = e^x - 1 \rightarrow \frac{1}{(GR)^2 - 1} + 1 = e^x \rightarrow x = \ln\left(\frac{1}{(GR)^2 - 1} + 1\right). \qquad (h)$$

Because of the equality $\frac{1}{(GR)^2-1} + 1 = (GR)$ (See appendix 4) holds

$$x = ln(GR). \qquad (i)$$

Or

$$\frac{m_{ground}^2 c^2}{k} = ln(GR). \qquad (j)$$

Applying the relation $k = m_{ground}^2 a_{free}^2 c^2$ holds

$$\frac{m_{ground}^2 c^2}{m_{ground}^2 \, a_{free}^2 c^2} = ln(GR). \qquad (k)$$

And the related free speed reflects the golden ratio

$$a_{free} = \frac{1}{\sqrt{ln(GR)}} = 1.441 \ldots \qquad (l)$$

APPEN40DIX 3

Applying again the relation (j)

$$\frac{m_{ground}^2 c^2}{k} = ln(GR). \qquad (m)$$

We obtain

$$m_{ground} = \sqrt{\frac{k}{c^2}\ln(GR)}. \qquad (n)$$

Then for the ordinary matter with the dynamics constant $k = hc$ [3] the related ground mass yields

$$m_{ground} = \sqrt{\frac{hc}{c^2}\ln(GR)} = \sqrt{\frac{h}{c}\ln(GR)} = 1.031 \, x \, 10^{-21} kg. \qquad (o)$$

APPENDIX 4

$$If \; \frac{1}{(GR)^2 - 1} + 1 = (GR). \qquad (p)$$

Then by substitution $(GR) = x$ we have

$$\frac{1}{x^2-1}+1 = x. \tag{q}$$

Rearranging step by step we obtain the quadratic equation

$$1 + x^2 - 1 = x(x^2-1). \tag{r}$$

$$x^2 = x^3 - x. \tag{s}$$

$$x = x^2 - 1. \tag{t}$$

$$x^2 - x - 1 = 0. \tag{u}$$

With the positive result which proves the proposed equality (o)

$$x = \frac{1+\sqrt{1+4}}{2} = \frac{1+\sqrt{5}}{2} = 1.618 \ldots = (GR)\,. \tag{v}$$

APPENDIX 5

By definition the ground mass and the free speed are in inverse proportion:

$$a_{free} = \frac{\sqrt{k}}{c}\frac{1}{m_{ground}}. \tag{w}$$

So

$$a_{free}(0) = \frac{\sqrt{k}}{c}\frac{1}{0} = \infty. \tag{x}$$

At zero ground mass $\frac{m_{ground}^2 c^2}{k} = 0$ we have

$$a_{minimal}(0) = \sqrt{\frac{1}{e^0-1}+1} - \frac{1}{\sqrt{\frac{1}{e^0-1}+1}} = \infty. \tag{y}$$

And also

$$a_{maximal}(0) = \sqrt{\frac{1}{e^0-1}+1} = \infty. \tag{z}$$

ADDENDUM

Let's calculate the relativistic mass of the object possessing the luminal minimal relativistic speed, too. At this speed the next pair of relativistic and ground mass is given[1]:

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

What for $m_{ground} = 1.031\ x\ 10^{-21} kg$ and $k = hc$ (o) gives

$$m_{relativistic} = 1.147x\ 10^{-21} kg. \tag{\beta}$$

Citation: *Janez Špringer. " Golden Ratio near Border of Elliptic and Hyperbolic Universe" International Journal of Advanced Research in Physical Science (IJARPS), vol 12, no. 07, pp. 1-4, 2025.*